CHOLERA:

WHAT CAN THE STATE DO TO PREVENT IT?

J. M. CUNINGHAM.

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Cholera:

What can the STATE *do to Prevent it?*

BY

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PREFACE.

AT a time when parts of Europe are suffering severely from cholera, and the whole Continent both of Europe and America is alarmed at the threatened advance of the epidemic, a few of the great facts showing what has been the experience of India in regard to this disease are deserving of special attention. And with these Indian facts it may be useful to recall the great facts regarding the history of cholera in other countries which are little known to the general public, and the significance of which is commonly misunderstood. The following pages in which I have discussed this subject were commenced with the intention of their forming an Introduction to the Twentieth Annual Report of the Sanitary Commissioner with the Government of India,—the last of these reports with which I shall have to do,—but as the work increased beyond the convenient limits of an Introduction, it was resolved to issue it in a separate form.

The object I have in view is not to put forward any new theory in regard to cholera, or to support any of the numerous theories which have been advanced by others. It may be urged that many of the expressions used in the following pages really do involve a theory, such expressions for example as the "invasion" of an epidemic and others which might be cited, but these expressions which seem to speak the language of theory, are used simply because there is no other way of stating the facts in an intelligible manner. My object is to discuss the whole question from a purely *practical* point of view; to examine how far the action taken by different Governments in order to arrest the progress of epidemic cholera has been productive of good and how far it has been productive of evil; and to point out, from the thirty-three years' experience I have had of India and the twenty years' experience I have had of the working of the Sanitary Department in India, what has proved to be the only effectual means of meeting the disease. The so-called sanitary measures which have been adopted by most of the continental nations of Europe and also by America are based on certain theories. Whether these theories are scientifically correct

or not is a matter of very minor importance. It is true they are negatived by all the great facts in the history of cholera both in India and in other countries, but the main question with which I wish to deal is, *not* whether they are true or false, but whether the action taken on them has been of the smallest benefit to mankind.

In a letter to the *Times*, dated the 17th July 1883, I remarked, "We are now seeing in Egypt the terrible results of alarm based on the theory of the existence of a special poison emanating from the sick, and if the epidemic advance we shall have much more of a like lamentable kind. Quarantine and cordons and disinfection and isolation of the sick cannot arrest cholera or limit its extent. . . . . Events will soon show whether what I have said is true or not." Events so far have unfortunately shown only too forcibly that it is true.

It requires very little knowledge of what has occurred to realise not only that no benefit has accrued from such action, but that an incalculable amount of harm has been done by it. Indeed, it is not too much to say that the mischief directly due to cholera, great as it is, has been a mere nothing compared with the mischief which

has been due to quarantine and cordons and other restrictive measures which have been carried out in the hope of preventing the extension of the disease. Such measures are all based on the commonly-accepted theories, and for them the supporters of these theories, however much they may repudiate all share in the matter, are wholly responsible.

The policy of the Government of India is to reject all theories as a basis of practical sanitary work. They are guided by their large experience, and this experience teaches in the most unmistakeable language that, in dealing with cholera, theories cannot be taken as a guide for any useful action on the part of the State; that by improvements in the condition of localities a vast amount of good may be done, but that any attempt to carry the doctrine of contagion into practice does no good, and is productive of much harm, not only because it involves oppression, but also because it vastly aggravates all the evils it is intended to prevent.

These are the only sound principles which can be followed by the State, and I look forward with confidence to the day when all nations will realise the truth of them. I trust that in this country they may never be departed from, for

their maintenance is essential to the happiness and prosperity of the people of India, among whom I have spent so many years of my life and in whom I feel a deep interest.

J. M. C.

CALCUTTA,
November 1884.

Cholera:

What can the State do to Prevent it?

Introductory Remarks.

THE Sanitary Department of India has now been in existence for more than twenty years. Concerned as it has been with all forms of disease, it has been occupied specially with cholera—in collecting information concerning this more than ordinarily mysterious disease, in devising measures best calculated to arrest it and in watching the practical results of these measures. The questions involved are questions of the deepest interest not only to the people of India, but to the people of all other countries. They involve the health and happiness of millions of homes in all parts of the world. Nor is any professional knowledge required for a right understanding of them. Viewed apart from all prejudice and preconceived opinions they are very simple, and their practical application very plain.

The questions to be dealt with are of great practical importance.

Arranged in convenient order, these questions stand thus:—

Division of the subject.

(1) How far are the common beliefs in regard to cholera supported by facts in India?

(2) How far are these beliefs supported by facts in other countries?

(3) What evidence and arguments have been advanced in opposition to these facts; and

(4) What is the practical conclusion of the whole matter? What can be done for the prevention of cholera, and how far are the measures now taken by some Governments in order to protect the people from this disease calculated to do harm instead of good?

Under each of these heads endeavour will be made to state the general facts and conclusions concisely. To enter into details would occupy too much time and space, and add needless matter to cholera literature, already so extensive and so confusing.

Opinions commonly held regarding cholera.

Before dealing with the facts, it is necessary to glance very shortly at the common opinions which are entertained regarding cholera. According to popular belief, cholera is a disease which up to the beginning of the present century had never been seen before; in the year 1817 it appeared in one of the eastern districts of Lower Bengal, and there, in the delta of the Ganges, it has remained ever since, sometimes spreading to other parts of India, and at other times, but more rarely, to other countries of Asia, Europe and also to America. Both by the public and to a large extent by the medical profession also,

the doctrine has gradually been arrived at that the cause of this mysterious disease is a specific germ which is taken into the body; that in certain persons who are not "susceptible," there is no result; but that when it does take effect and causes the disease, it is multiplied to an almost indefinite extent, all these resulting germs being as potent as that from which they originated; that these germs are given off by the discharges of those suffering from cholera, and that the disease is spread, and can be spread only, by the distribution of these germs, either directly by human beings, or indirectly through means of clothing or merchandise or other things which have become "contaminated," as it is called, with these germs produced by human beings. Human beings, in other words, are both the manufacturers and the disseminators of cholera. The most common mode by which the germs are supposed to be distributed is the water-supply—the discharges find their way into the water, and are thus widely and readily distributed. And from these beliefs the further conclusions have been formed that, without human intercourse of some kind or other, it is quite impossible for cholera to extend, that if human intercourse could be prevented cholera also would be arrested, and that therefore all traffic of human beings or merchandise should be under such regulations of quarantine or medical inspection that the danger of cholera germs being introduced into any country and any community may be averted.

CHAPTER I.

Facts regarding Cholera in India.

Cholera has been known in India from the earliest times.

In considering the facts regarding cholera in India, the first thing to be clearly understood is that this is no new enemy of mankind which arose in the district of Jessore in the year 1817, as has been popularly supposed. The disease can be distinctly traced in this country from the fifteenth century, and indeed it has been known from the earliest times of which there is any record. The description given in these early records of the symptoms—the suddenness of the attack, the vomiting and purging followed rapidly by collapse and often within a few hours by death—is unmistakeable, while the fact that such cases occurred not only in individual instances, but also in severe epidemics, leaves no doubt whatever that the cholera in India of to-day is exactly the same as it was at least 400 years ago, and as it probably ever has been. There are records of a severe epidemic of it at Goa in 1543, where the Portuguese knew it under the name of *moryxy;* and in the earliest European work on Indian medicine, which was published at Goa by Garcia d'Orta in 1563, the symptoms are fully described. The disease was known by several other names, but it is sufficient for the present purpose to note that attacks presenting all the symptoms which are now known under the name of cholera have been recognised in India from the earliest times,

and have prevailed with more or less severity up to the present day.

It is only since the Sanitary Department was created that any systematic attempt has been made to collect statistics regarding this and other diseases in India. In 1868 the registration of deaths was introduced into the different provinces, and it has been one of the main duties of the Sanitary Commissioners to improve this registration as the most valuable means not only of ascertaining the annual history of disease, but also of ascertaining from the death-rate where sanitary reforms are most needed, and of interesting the people in the accomplishment of them. Information may now be obtained regarding the more common causes of death, and in this way the general course may be traced, not only of the ordinary distribution of disease but also of epidemics. In these statistics year after year cholera has taken a prominent place, and the facts so recorded, however they may be interpreted, must be regarded as facts of very great importance.

Since the Sanitary Department was established, much information regarding cholera in India has been collected annually.

In the following Table the number of deaths annually recorded in the provinces of India during the ten years, 1874–83, is entered.

The general statistics of deaths from cholera in India during the ten years 1874–83 are shown in the annexed statement.

Annual Deaths from Cholera in India, 1874 to 1883.

Province.	Population.	Deaths from Cholera.									
		1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.
Bengal* . .	66,106,026	56,876	109,988	196,590	155,305	95,192	136,363	39,643	79,180	182,352	90,439
Assam . . .	4,483,705	16,478	6,618	8,615	11,377	6,732	17,415	2,803	5,010	21,055	14.908
North-Western Provinces and Oudh	44,107,869	6,464	64,427	48,311	31,770	22,221	35,892	71,546	25,865	89,372	18,160
Punjab. . .	18,842,264	78	6,246	5,736	29	215	26,135	274	5,207	39	190
Central Provinces .	8,802,040	14	14,643	20,124	3,418	40,985	27,575	330	9,140	11,932	16,235
Berar . . .	2,630,018	2	22,465	2,683	842	34,306	223	1	3,404	3,573	27,897
Rajputana . .	‡	†	1,203	283	60	2,393	918	...	197	1,327	797
Central India .	‡	†	2,555	1,929	926	8,047	2,734	299	581	1,562	1,740
Bombay . .	16,454,414	37	47,573	32,117	57,228	46,743	6,937	684	16,694	7,904	37.954
Hyderabad . .	‡	†	10,891	5,582	7,414	6,696	6	..	1,721	150	1,947
Madras . .	28,887,111	313	94,547	148,189	357,430	47,167	13,296	613	9,446	23,604	36,284
Mysore . .	4,186,188	†	2,504	12,087	2,902	723	14	25	25	893	124
Coorg . . .	178,302	†	†	210	†	49	...	...	3	31	...
British Burma .	3,663,923	960	761	3,678	7,276	6,759	1,828	2,638	5,239	7,177	2,185

* Excluding Calcutta. † Statistics not available. ‡ Population not known.

This statement will serve to show the vast field of observation which India affords for the study of such a disease,—vast not only in its area and in its population, but vast also in the enormous number of cases, for it may be estimated that the deaths represent only one half of the attacks. It will be observed that the disease appears year after year in nearly every part of the country, but that all the provinces have their years of epidemic prevalence as compared with years of marked abeyance. In Bengal, for example, the number of deaths has fluctuated between 39,643 in 1880 and 196,590 in 1876. In the North-Western Provinces it has fluctuated between 6,464 in 1874 and 89,372 in 1882. In the other provinces the contrasts are even more striking:

In the Punjab between	29 in 1877 and	26,135 in 1879
In the C. P. between	14 in 1874 and	40,985 in 1878
In Berar between	1 in 1880 and	34,306 in 1878
In Bombay between	37 in 1874 and	57,228 in 1877
and in Madras between	313 in 1874 and	357,430 in 1877.

The statistics, though imperfect, are of great value.

The statistics are no doubt imperfect, but of their general accuracy as representing the great facts respecting cholera distribution in India there can be no question. There are many good grounds for coming to this conclusion. There can be no collusion among the very numerous and illiterate collecting agency, yet the records tell a consistent story from year to year and from district to district. The deaths registered on the border districts of one province often

fit in and tally in a remarkable manner with the history of the disease as recorded by the deaths registered in the neighbouring districts of another province. Moreover, the general accuracy of the registration among the people from year to year is corroborated by the concurrent statistics of troops and prisoners scattered over the general area of registration, and the facts regarding them are recorded with a care and accuracy about which there can be no dispute. The statistics of cholera among the people of India, as represented by the deaths registered under this head, must therefore be accepted as a most valuable contribution to our knowledge of the disease; and before coming to any conclusions regarding it, these statistics must be carefully examined with a view to ascertain, if possible, what these and other facts which have been collected during the years the Sanitary Department of India has been in existence really teach.

The statements in the appendix show that there is a marked relation between cholera distribution and season.

But in order to arrive at any sound conclusions, it is necessary to take these facts more in detail, district by district, and for this purpose the statements in the appendix have been prepared by the statistical officer, Dr. Stephen. These statements were compiled primarily with the object of studying the seasonal prevalence of cholera in different parts of India. It will be convenient, therefore, to examine what the main facts are on this point. First there is the endemic area, the area from which cholera is never absent. In Statement I, which includes the twenty

districts which may be described as forming the central portion of the endemic area, there are two periods of maximum prevalence,—one during the winter months, November, December, and January; and the other during the spring months, March, April, and May. During the months of July, August, and September, the rainy season, there is comparatively little cholera. Within this area, during the twelve years 1871–1882, 44 per cent. of the cholera deaths occurred in the winter, 38·7 in the spring, and only 3·7 in the rains. In the second statement, which embraces seven districts lying to the south and south-west of the endemic area, the spring cholera is much the same as in the group included in Statement I, the winter cholera is less, but the cholera of the monsoon or rainy season is much more marked. In the third group the winter cholera almost disappears; the spring cholera is comparatively unimportant, and the majority of deaths takes place in the monsoon. In the fourth group, again, the monsoon cholera has decidedly diminished, and the spring cholera assumed much greater importance. It is not necessary to follow the details further here, because they are shown very clearly in the tabular statements, and there the monthly ratios in different groups can be more conveniently compared. It need only be remarked by way of explanation that the districts of the Madras Presidency, of British Burma, and of Assam have been shown in Provincial Tables Nos. XII, XIII and XIV irrespective of season. They were added after the other tables had been prepared, as well as No. XV,

in which are included a few districts of other provinces presenting peculiarities of seasonal distribution. The great facts to be derived from a study of the first eleven statements are that in the same areas year after year cholera rises and falls with great regularity at the same season or seasons, and that these seasons of rise and fall differ much in different parts of the country.

In the endemic area there are marked differences between the extent of cholera in different districts.

It will be seen from these same statements, and the fact is brought out still more clearly from the detailed annual figures from which these statements were prepared, that certain districts suffer more or less severely from cholera year after year and month after month. They form the groups shown in the first and second statements. It will be observed that while the average annual death-rate from cholera in the first is 18·08 per 10,000 of population, and in the second 16·60, the ratios in individual districts vary enormously — some suffer very much more than others. For example, in the first group, the annual death-rate varies from 49·51 in the district of Noakhally to 6·05 in Dinagepore; in the second group it varies from 35·27 in the district of Balasore to 6·44 in Rajmehal and Deogarh. Making every allowance for the admitted imperfection of the statistics, there can be no doubt that even within the endemic area some districts suffer with more persistent severity than others. This endemic area includes the delta of the Ganges, but it includes much more. It is

usual to speak of and to show the endemic area in the map as if it were a well-defined area, but, as a matter of fact, it is by no means well defined, and shades off gradually in all directions. Indeed, so gradual is the shading that it is impossible to say where the endemic area ceases.

The districts outside the endemic area may be divided into three great classes.

The districts which are not usually considered as belonging to the endemic area may be divided into three great classes. First, there are those which, although they do not suffer continuously, yet suffer much more persistently and severely than others. To this class belong some of the eastern districts of the North-Western Provinces; such, for example, as Benares, Jaunpore, Gorakhpur, and Bustee, with most of the districts of Oudh, as Sultanpore, Gondah, Rae Bareilly, and Sitapore. Secondly, there are those which, as a rule, suffer little, but are subject at intervals to violent epidemics. Such are many of the districts of the Central Provinces and of the Punjab, which may escape for months and even years without any deaths being registered from cholera, and then show a large mortality from this cause. Of this class, Ferozepore is a good example. Its average annual cholera mortality for the twelve years was 3·24; but this is practically made up of the results of two epidemics, one in 1872 and the other in 1879. In all the other years, the deaths from cholera are represented by a small fraction. A third class consists of districts which are remarkably exempt from cholera at nearly all

times, where in ordinary years cholera may be said to be practically unknown, and where even in epidemic years the number of cases is very small. Of this class the districts of Montgomery, Mooltan, Muzaffargarh, and Dera Ghazi Khan in the Punjab are striking examples. These illustrations are all drawn from the Bengal Presidency, but others may be found in Madras and Bombay on referring to the particulars which are given in the statements.

In all the divisions and also in the endemic area there is a marked difference in different years.

In all parts of the country there is a most marked difference between the results of different years. In some years the disease is in abeyance, in others it is epidemic, and between these extremes there are many gradations. Even in the endemic districts, the difference between an epidemic and a non-epidemic year is very striking. In Nuddea, for example, in 1871 only 528 deaths from cholera were registered, in 1882 the number was 11,020. In Backergunge in 1871 the number was 291, in 1877 it was 19,177. Similar results are to be seen in the districts outside the endemic area. In the Tirhoot and Durbhanga districts combined there were 85 deaths from cholera in one year, and 23,025 in another. In Banda there were 7 deaths registered from cholera in 1874, and 2,337 in 1882. In the Jaunpore district the range was between 15 and 8,251; in Gorakhpur between 61 and 8,314; in Rae Bareilly between 4 and 6,635; in Gonda between 0 and 6,122. Or to take some examples from the Central Provinces and Berar, the

number of cholera deaths in Raipore one year was 17,076, in another year not one was recorded. In Wun there was a maximum of 4,891, in Bassim of 11,698, in Akola of 7,847, in Buldana of 7,414, in Khandeish of 6,224, and yet in all these districts in one or other year the cholera death register was blank. In Montgomery in six out of the twelve years not a single death from cholera was registered. Of the small total of 115 during the twelve years, 101 were registered in the year 1879. Numerous examples of a like kind will be found in the columns of the statements which show the maximum and minimum annual mortality during the twelve years included in them. It is not to be supposed from the above remarks that the periods of cholera abeyance and cholera prevalence occur simultaneously all over the country. The case is rather the reverse. In a year when one province is suffering, another may be enjoying remarkable immunity. It does, however, usually happen that marked cholera abeyance or cholera prevalence is observable over large areas—areas which often include many districts. In some years, as notably in 1874, there was a marked abeyance of cholera over the greater part of India.

Isolated cases are frequent in all parts.

In the endemic area and in the districts lying around this area, cholera, as a rule, occurs rather in a large number of individual cases here and there than in epidemic outbursts. Outside the endemic area, in places indeed which are far removed from it and in which cholera

is but seldom seen, there still occur isolated cases every now and then. The detailed statements furnish many instances of districts in which literally only one or two deaths from cholera have been reported during the whole year, and this may occur for several years together, with the variation that sometimes none are recorded at all. It is of the greatest importance to note these cases, because without a proper apprehension of them no just estimate can be formed of the facts. It is the fashion by some to regard them as not cases of cholera at all, but as evidences of the inaccuracy of the returns, which have shown deaths due to indigestion, or it may be to arsenical poisoning or some other cause, as having been due to cholera; but cases of a like isolated kind are constantly returned from military and civil hospitals, where there can be no doubt whatever that, so far as the symptoms and in many cases so far as the *post-mortem* appearances are concerned, death was really due to cholera. Such cases are sometimes the forerunners of an epidemic. In the Upper Provinces when they occur in the spring, they often seem to betoken the epidemic which follows in the rains. But in other years they seem to be isolated attacks without any epidemic significance. By some they are described as "sporadic;" in Europe they would be called cases of "cholera nostras"; but in order to avoid all theorising as far as possible, it will be best for the present at least to speak of them simply as cases of cholera.

It is further to be remarked as one of the impor-

tant points illustrated by the statements that the districts outside the endemic area which suffer to the greatest extent from cholera are not those which are nearest to the endemic area, or most closely connected with it by easy means of communication. Nor is the reverse true that those districts which escape are comparatively isolated and removed from intercourse with the endemic area. It has already been shown that some of the eastern districts of the North-Western Provinces and Oudh suffer with exceptional severity. Many of them are comparatively inaccessible, while others which lie either close beside them, and through which there is constant traffic by railway, escape with comparatively little loss. In illustration of this, the following examples may be taken, in which the average annual cholera death-rate per 10,000 of population for the twelve years is set opposite each :—

The districts which suffer most are not those in most direct or constant communication with the endemic area.

Districts away from the railway and comparatively difficult of access.		*Districts on the line of railway.*	
Azamgarh	11·17	Allahabad	7·37
Gorakhpur	12·65	Futtehpur	5·06
Basti	22·60	Cawnpore	5·13
Gonda	19·38	Etawah	3·67
Bahraich	14·97	Unao	7·04
Kheri	14·45	Lucknow	8·88

Several of these districts lie side by side, but those which suffer far the most are those which are the most inaccessible. Those which lie on the main line of traffic suffer much less. Or to take the case of the

Punjab districts already referred to as enjoying such a remarkable immunity from cholera, two of them, Montgomery and Mooltan, are traversed by the railway running from Amritsar and Lahore to Kurrachee, along which there is constant traffic, and the result is as follows. All four districts lie on the line of railway and bear the same relation to the traffic of the country. Yet the contrast is most marked. Amritsar and Lahore suffer considerably while Montgomery and Mooltan almost entirely escape.

Annual average cholera death-rate per 10,000 of population for the 12 years.

Amritsar	2·89
Lahore	4·94
Montgomery	·24
Mooltan	·06

The above facts regarding the general population are fully borne out by the experience of troops and prisoners.

The story which is told by these statistics concerning the general population of the country is fully corroborated by the exact statistics of troops and prisoners. The distribution of cholera among them follows the same general laws. So marked is the influence of season that great epidemics after several years' interval have frequently recurred almost on the same day of the year, and what is perhaps the most noteworthy point of all, there are certain places which, as a rule, suffer severely when attacked, and there are other places which suffer very little, and yet to all appearance there is no reason except their

geographical and physical position which satisfactorily accounts for the marked difference. Among cantonments that suffer much may be mentioned Allahabad, Meean Meer, and Peshawur, while Mooltan, Sialkot, and Nowshera suffer little, as may be seen by the following figures showing the average annual cholera death-rate for the 10 years 1860–69:—

Allahabad	19·53
Meean Meer	46·27
Peshawar	24·75
Mooltan	·00
Sialkot	·80
Nowshera	·93

The frequent escape of the troops in hill stations even in times of widespread epidemic prevalence entirely accords with the general history of the disease among the ordinary population.

Even during epidemic prevalence the area attacked does not suffer in all its parts.

There are other important facts which are not recorded in the statements, and which cannot well be figured in statistical tables. These now deserve attention. Among them the first to be noted is that even when cholera appears in epidemic violence, towns and villages are not by any means all attacked. The popular belief regarding cholera is that once having been imported the disease is passed on from one person to another, and from one part of the country to another, until all is involved, but no idea could well be more unlike the truth. An epidemic of cholera is not a history of gradual spread from a centre

or from many centres, but a history of outbreaks localised in a comparatively small number of the inhabited towns and villages. As stated in the special report on the cholera epidemic of 1879 in Northern India, "The facts from year to year all bear out the same conclusion, that the distribution of cholera is never universal; that it frequently shows itself in only a few towns and villages; that these are not confined to one corner of a district, but scattered at considerable intervals, and that even within the area of a severe epidemic, the proportion of villages attacked is generally small compared with the proportion which escapes." To take a few illustrations at random. In 1882 the North-Western Provinces suffered severely from cholera—89,372 deaths from this cause were recorded. They were recorded in 668 out of 1,143 circles of registration, so that the disease was widely spread, but of 105,421 villages and towns in the province only 10,838 suffered. Or to take a few of the districts in which the disease was most severe:

In Lucknow, out of 947 towns and villages, 197 recorded deaths.

In Bara Banki, out of 2,061 towns and villages, 283 recorded deaths.

In Sultanpur, out of 2,460 towns and villages, 829 recorded deaths.

In this last district nearly 5,000 persons died, or 5·05 per 1,000 of population, and the proportion of towns and villages attacked is unusually high. In the Central Provinces in 1878, a year of epidemic prevalence in that part of the country, the results for the

province as a whole and for some of the districts which suffered most are as follows ; and to them may be added a few illustrations from the Punjab in 1879, when the last severe epidemic occurred in this part of India :

In the Central Provinces (1878), out of 27,306 towns and villages, 3,025 were attacked.

In the Nimar district in the Central Provinces, out of 472 towns and villages, 124 were attacked.

In Burhanpur district, out of 123 towns and villages, 24 were attacked.

In Nagpur district, out of 1,699 towns and villages, 321 were attacked.

In the Punjab (1879), out of 34,973 towns and villages, 3,753 were attacked.

In Hissar district, out of 715 towns and villages, 334 were attacked.

In Rohtak district, out of 498 towns and villages, 180 were attacked.

In Kohat district, out of 469 towns and villages, 107 were attacked.

In the districts of the Central Provinces above cited the disease was most severe. In Nimar the cholera mortality equalled 10·08 and in Burhanpur 14·79 per 1,000. In the Punjab examples, the proportion of towns and villages attacked is much in excess of what is usual, but it is still much less than the proportion which escaped. The same story of exempted places is repeated year after year. And here again the experience of the troops and prisoners affords evidence of the general truth of the facts collected from among the people of the country, for the proportion of barracks

attacked in a cantonment or jail is, as a rule, but a small part of the whole.

Relation between the intensity of an epidemic and the number of places attacked.

Another important fact is the relation between the number of places attacked and the intensity of the epidemic. This point was specially noticed in the report on the 1879 epidemic already referred to. It was then remarked that "so far as the evidence goes it would appear that the intensity of an epidemic is manifested not only by the death-rate, but also by the number of different places in which the disease shows itself, although in many of these it may show itself in only a very few cases." This peculiarity is to some extent illustrated in the examples above given. The subject is deserving of further investigation. If any general law of this kind can be established, it is evident that it must have a very decided bearing on the question of the diffusion of cholera.

Different epidemics differ much in severity.

That one epidemic is much more severe than another is a fact which cannot be disputed, and the importance of which, in arriving at a just estimate of the epidemiology of cholera, cannot be over-estimated. Of this the experience of the Punjab in the great epidemics of 1867 and 1879 affords an excellent illustration. Both these epidemics were ascribed to the pilgrims returning from the Hurdwar fair. The epidemic of 1867 was much more severe than the epidemic of 1879. The total cholera mortality for the province in the one year was 2·46 per 1,000, in the other it was only 1·49. And

not only was this true of the province as a whole, but it was true also of every one of the 32 districts except five. In point of relative severity the two epidemics were distributed very much in the same way—the districts which suffered most in the one year suffered most in the other, and those which suffered least in the one year suffered least in the other.

Epidemics have a general definite direction.

The direction taken by epidemics is another matter which requires careful consideration. In the Bengal Presidency, for example, the direction of an epidemic is always upwards. Such a thing as an epidemic moving downwards is absolutely unknown. The fact is of great importance, not only in itself, but also in regulating the movement of troops, and it was taken advantage of after the Afghan war, when there was a fear, according to the ordinary opinions entertained regarding cholera, that bodies of men who were suffering from cholera in and beyond Peshawar might be the means of producing an epidemic lower down. There was no ground for alarm, and this opinion was fully justified by what occurred. The troops moved down, some of them suffered from cholera, but there was no downward movement of the epidemic. The direction of epidemics in the Upper Provinces is all the more worthy of notice, because the great drainage channels of the country into which much cholera matter must eventually find its way, run in the reverse direction to the epidemic. Were they the means of disseminating the disease, it should move downwards and not

upwards. In the Madras Presidency, as Dr. Bryden has shown, cholera invades not by the direct sea route, or from the neighbouring districts of Bengal, but by a very circuitous route through the Central Provinces.

Railways have had no influence on the distribution of cholera.

It has been already shown that places do not suffer in proportion to their accessibility from the endemic area, and that in fact the extent of cholera in them seems in no way dependent on the facility or the difficulty of reaching them. And the same remark is true of the India of to-day as compared with the India of a hundred years ago. Railways have increased the number of travellers enormously, they have placed the whole country within a few days' reach of the endemic area, and throughout the area beyond, where epidemics chiefly attract attention, they have placed one place in easy communication with another, when formerly the passage from one to the other was often tedious and difficult. Have railways and good roads and steamers which now traverse the country and ply from port to port increased the frequency of epidemics or rendered them more rapid in their progress? Have they changed their direction from what it used to be? The answer must be emphatically, No. The direction of epidemics is in no way altered, nor has their frequency been increased. Moreover they do not move more quickly than they did a hundred years ago, when there were no railways and no steamers, and very few roads.

There are certain places where cholera is practically unknown, although there is constant intercourse between them and cholera-stricken areas.

Mention has already been made of places where cholera is little known, but there are places in India in which it may be said that cholera is practically unknown. One of these is the convict settlement on the Andaman Islands, which has been occupied ever since 1858. The communication with Calcutta is constant, most of the supplies have been drawn from the heart of the endemic area of cholera, and yet to all intents and purposes it may be said that cholera is unknown in the place. The escape may be ascribed to quarantine, but the so-called quarantine has been little more than a name, and the immunity dates back over years before any, even nominal, quarantine was in existence, to a time before the idea had taken any hold in India that cholera could be imported by human intercourse, or that if it were, quarantine could do anything to prevent it. Other places having an analogous history of remarkable exemption might be mentioned. The hill station of Mussoorie, for example, although it is only seven miles from the plains where cholera is frequent, and draws all its supplies from the plains, has suffered less from cholera over a long series of years than most towns in Europe. Other examples of a like kind might be given.

Quarantine has failed to prevent cholera, and done much harm.

In India, experience has shown that all attempts to keep out cholera by means of quarantine have entirely failed. Quarantine has been tried again and again to pro-

tect a cantonment, and not a single instance can be cited in proof of its success. No doubt there have been cases in which such quarantine has been attempted and the cantonment has escaped, but there are abundant instances of escape when there was no quarantine. In no instance is there evidence to lead to the conclusion that the cantonment or other community concerned was protected by the quarantine. On the other hand, the mischief which has been done by such endeavours has beyond all question been very great. Such a system is impossible without leading to oppression and hardship to the people, and exposing them to all the evils which specially arise in a country like this, where the police is so venal and the population so submissive. The arguments against quarantine as applied to any tract of country are still stronger than when applied to the case of a cantonment. The feeling of the people undoubtedly is that they would rather face all the dangers of cholera than be subjected to quarantine interference, and any one who knows the circumstances can fully sympathise with them in this feeling. So satisfied has the Government been of the futility of quarantine to do any good and its power to do evil, that quarantine in India has been altogether prohibited. Occasionally, though rarely, cordons have been drawn by the local authorities around villages suffering from cholera, in the hope that the disease might be arrested by this means, but in the case of such cordons there are all the difficulties and dangers of quarantine, and besides all these there is the inhu-

manity of attempting to keep people within the spot where the cause of the disease is at work, and where therefore there is the greatest reason to fear an attack. In India, so far as all experience goes, to impose quarantine or cordons in order to keep out cholera is a proceeding no more logical or effectual than it would be to post a line of sentries to stop the monsoon.

Isolation of the sick and disinfection have proved powerless to arrest an outbreak.

As quarantine or cordons, or both combined, have been powerless to arrest the progress of an epidemic, so isolation of the sick and disinfection have been equally powerless to arrest an outbreak once it has commenced. Among troops and prisoners these measures are tried, and very properly tried, but so little confidence is reposed in them that, when a single case occurs, removal from the affected room or building is compulsory. If a third case occur among any body of troops, then they are immediately removed into camp.[1] Experience has fully proved the wisdom of these rules. Frequently, as has been already explained, cholera is limited to one or two cases in a place, and where isolation and disinfection have been practised it may hastily be concluded that the outbreak has been limited by these means; but isolated cases are common in villages and towns where isolation and disinfection are never practised, and were common long before these measures were considered as likely to arrest cholera.

[1] See rules for the management of cholera issued by the Quarter-Master-General, July 1877.

Removal from the affected locality is the only means of arresting an outbreak.

Once there is evidence that a severe outbreak is threatened, removal from the affected locality is the only measure which is productive of benefit, and this measure in India has been most successfully carried out in the case of both troops and prisoners times without number. It has proved successful even when the party moved have carried their sick to the new place, and have drawn their supplies, including their water-supply, from the affected place which they had left. For successful removal, it is essential that the measure be carried out *early* before the influences of the affected place have done evil, and the chances of success are much increased if removal be to some distance and to a place where cholera as shown by experience is little wont to prevail. The benefits of early removal of troops from the cantonment of Meean Meer along the line of railway for 100 miles or more towards Mooltan, till that region is reached where, as already mentioned, cholera is rarely found, have been again and again exemplified. In 1881, when the last outbreak occurred at Meean Meer, the decided results which followed from such a move were most strikingly illustrated. The body of troops removed had not a single case after leaving Meean Meer; twice they returned to the cantonment, and twice having been again attacked, they found safety in their distant place of shelter. Nor need any fear be entertained that the removal of bodies of men even when suffering from cholera will prove a source of

danger to the community at large, and especially to the community to whose neighbourhood they have gone. Among the many moves made in this country there is no instance of this kind on record. On the contrary, there is much evidence the other way. Of this a remarkable instance was afforded in 1872, when, in consequence of a severe outbreak of cholera among the boys of St. Peter's College, Agra, 65 were sent to their homes in different parts of the country. Of these 12 were attacked and 5 died, but in not a single instance did a boy cause any attack in the place where he was sent.[1] The benefits of movement can be explained only by remembering that localisation is one of the most remarkable peculiarities of cholera. As shown by the statistics of towns and villages and of barracks occupied by troops and prisoners, the localities exempted are, as a rule, more numerous than the localities affected. A change from an affected locality will, it is hoped, lead to the occupation of a locality which is not affected, but the hope is not always realised, and then further movement must be made. When, as in the case of the area lying towards Mooltan, movement is made to a place little subject to cholera, the result is naturally most likely to be successful, especially if the move be made early.

Attendants on the sick suffer no more than others.

Since 1877 a record has been kept of the number of attendants on cholera cases treated in military or jail hospitals throughout India, and the number of these that have

[1] See Annual Report of the Sanitary Commissioner with the Government of India for 1872, page 71.

themselves been attacked. The body of evidence thus accumulated stands thus:

Number of cases of cholera concerned .	5,696
Number of attendants on these cases .	10,599
Number of these attendants themselves attacked	201
Percentage of attendants attacked . . .	1·9

Considering that one case of cholera occurring in a community has been so often regarded as the cause of hundreds and indeed thousands of deaths from the disease, the result that 5,696 cases of cholera under careful observation can be credited with only 201 attacks at the utmost is very remarkable. The fallacies which surround this question are many, but they all tend to attach undue importance to the mere fact of attendance on the sick, and to make the proportion of attacks in the above statement, small as it is, larger than it ought to be. If an attendant is attacked, it is too often assumed that contact with the cholera patient must have been the cause of attack, although other persons in the same place who have not come in contact with the sick have suffered quite as much as the attendants. The circumstances under which the attendants are placed are all favourable to attack—the want of rest, fatigue, and in many cases anxiety and sorrow. And especially in these later days the element of fear is not to be left out of account, for experience shows that it has a very baneful influence, and that it induces a proneness to cholera. When attendants enter on their duties under the impression that they are undertaking a service of extreme danger, it would

not be surprising if they did suffer severely. It is of the greatest importance, not only in the interests of the sick, but also of the public at large, that this delusion should be dispelled, for it is altogether contradicted by the most carefully recorded statistics.

Other facts deserving attention.

Among other facts which deserve attention in the Indian experience of cholera are—

(*a*) The frequent prevalence of diarrhœa, both before and during a cholera outbreak, showing the general influence which seems to affect the community.

(*b*) The importance of checking this diarrhœa at once, as one of the most successful means of dealing with an outbreak.

(*c*) The danger during a cholera time of producing the disease by taking saline or other violent purgatives which might be taken with perfect safety at ordinary times.

(*d*) Epidemics not unlike cholera occur under circumstances which leave no room for supposing that they are due to anything but peculiar atmospheric conditions localised in a strange and unaccountable manner. The Simla epidemic of 1880 is a remarkable illustration of this. It is thus described in the Sixteenth Annual Report of the Sanitary Commissioner with the Government of India :—

"From about the 13th of June till the end of the

first week in July 1880, nearly the whole adult male population of the place was more or less prostrated by copious, painless, and severe diarrhœa, attended with great depression, and often with vomiting. Very few escaped, and many of those who did escape the diarrhœa suffered from nausea, loss of appetite, and general *malaise*. A few cases had occurred before the 13th June, and a few others occurred after the 8th July; but these last were chiefly relapses in those formerly attacked. The extreme prevalence of the disease when it was at its height was matter of common talk at the time. The Government dispensaries and the druggists' shops for days were almost besieged with prescriptions for astringent and other remedies, but no remedies seemed to have the smallest effect. In the Park Hotel every adult resident was attacked, as well as the family of the proprietor and many of the servants. In a house near the top of Jacko (8,000 feet) only one out of five adults escaped. In another house with five adult residents only one escaped. In the United Service Club, out of thirty-four residents, two only are said to have been free of the disease. In Government House every European but one was attacked. Many other examples might be given to show how very generally the people were affected. There were, however, several remarkable points in the distribution of the epidemic. Europeans suffered much more than natives. European males suffered more than European females. Children almost entirely escaped; a case among them was extremely rare.

"Many efforts were made to discover the cause of this sickness; naturally the water was at first suspected. The new supply had only lately been brought in. It might be that, owing to some pollution of the gathering ground, or some defect in the soldering or other arrangements of the pipes, this new supply was at fault, but the arguments against any such conclusion were unanswerable—

"(*a*) The municipal water had been in use for weeks before the sickness commenced, and no ill-result had been observed.

This is no argument. It may have become contaminated a few days before the outbreak.

"(*b*) People still drew in parts of the settlement from the old springs, and they suffered just as much, and at the same time, as those who used municipal water.

"(*c*) It was most improbable, and indeed almost impossible, that these numerous springs and the municipal water could all have been defiled at or about the same time, especially as the gathering ground for the municipal supply is 14 miles from Simla in an open and almost uninhabited country. Over half an inch of rain had fallen on the 1st June, and there was none again till the 16th June; by that time the epidemic had been fully established. The *baolis*, or receptacles at the springs, hold but a few gallons at a time, and any pollution caused in them by the rain of the 1st June must have shown itself rapidly. Be-

sides, during the first half of May, rain had been frequent and heavy, but there had been no diarrhœa.

"(*d*) Non-water drinkers suffered as much as water-drinkers.

"(*e*) Children, who drink much more water than adults, enjoyed almost complete exemption.

"(*f*) It so happened that the municipal water was analysed shortly before the epidemic, as well as after, by Dr. Lewis, and was found to be as perfect as any water-supply can well be.

"The arguments against milk being the cause are stronger even than those against the water, for there are no dairies at Simla, and almost every family makes its own independent arrangements for cows. Children who use milk most suffered least."

These facts may be studied with advantage by those who believe that an outbreak of cholera can only be due to a specific germ propagated in the bodies of the sick.

Sanitary improvements have diminished cholera, as shown by the statistics of troops and prisoners during the last 23 years.

But, in a practical point of view, the most important of all the facts relating to cholera in India is that sanitary improvements have diminished cholera. Of this the statistics of both prisoners and troops afford abundant evidence. Among prisoners the results have been much disturbed by the effects of famines, which render any fair comparison, especially

in the Madras and Bombay Presidencies, impossible. In the Bengal Presidency, the great fact stands out that the annual average death-rate from cholera among prisoners during the period 1859 to 1867 was 10·77 per 1,000; in the next period, 1868 to 1876, it was 3·28; and in the third period, 1877 to 1883, it was 3·61. In the three Presidencies, among European troops, who are not subject to the disturbing effects of famines, the results are still more striking, and stand thus :—

Presidency.	Annual average death-rate from cholera.		
	1860–69.	1870–79.	1880–83.
Bengal . . .	9·24	4·18	2·49
Madras . . .	2·56	1·68	0·90
Bombay . . .	4·80	1·53	0·45

The periods are sufficiently long to establish the great truth that sanitary improvements—not one sanitary improvement only, but attention to all the requirements of health—have a marked effect in diminishing cholera. At the same time it must be remembered that the results cannot be constant, as they much depend in no small measure not only on the frequency with which epidemics recur, but also on their intensity.

Summary of the great facts regarding cholera in India.

The foregoing facts regarding cholera in India may be briefly summarised as follows :

(1) Cholera has been known in India from the earliest times.

(2) In Lower Bengal, over an area which cannot

be exactly defined, the cause or causes which produce cholera are always more or less present.

(3) Outside this area these causes are present with varying degrees of persistent intensity in different parts of the country.

(4) In some of these parts cholera is comparatively unknown, and generally present only in a very few isolated cases.

(5) In all parts, both within and without the endemic area, cholera is most prevalent at certain seasons of the year and least prevalent at other seasons, the prevalence being much greater in some years, known as epidemic years, than it is in others which are known as non-epidemic years.

(6) The areas of prevalence and freedom from cholera are in no way determined by the facility or difficulty of human intercourse, and the improved means of communication of more recent times have not altered the direction or frequency of epidemics, or the rate at which they travel.

(7) Quarantine and cordons have entirely failed to afford protection or to influence the progress of the disease.

(8) Attendants on the sick have not suffered more than others.

(9) Cholera extension, either in its direction or in its rate of progress, has no relation to

human intercourse or contact with the sick.

(10) The unknown cause or causes which produce cholera, although often widely manifested, are by no means universally present even within the general area covered by a severe epidemic, but are localized in a very remarkable manner.

(11) Sanitary improvements—improvements in the conditions of localities are the best safeguard against cholera, but if an outbreak threatens, early removal from the affected locality is the best means of escape.

CHAPTER II.

Facts regarding cholera out of India.

Indian experience is not valued as it ought to be.

But it may be said, and indeed it has been said, that all Indian experience in respect of cholera is of little or no value as a basis for forming correct conclusions on the cause or causes of the disease. All the facts, it is urged, which have been collected, very definite though these facts may be, very consistent in the story they tell, collected by many independent observers over a large area and over many years, still are all open to fallacy, and therefore not to be trusted. The source of *infection* in India is so close at hand, the chances through which this *infection* may be and are conveyed are so numerous and so impossible to discover, that India must be set aside as a field of cholera observation from which any really valuable data can be expected. This is indeed a strange doctrine, and one which cannot be admitted. The facts regarding cholera in India are of the greatest value, as all facts must be which are really facts and not merely a partial or inaccurate representation of facts moulded according to preconceived theories. And the data which have been collected by the Sanitary Department of India from troops and prisoners and the general population of the country during these twenty years, imperfect though these last may be, are still the most complete and valuable data which have

ever been collected regarding cholera. But setting aside all this, and accepting for the time the *dictum* that Indian facts are open to special sources of fallacy, the great facts regarding the disease out of India may now be examined and compared with those which have been observed in this country. Do they tell a different tale from that which has been already told?

Cholera has been known in other countries from the earliest times.

The first point to be observed is that, as cholera has been known in India from the earliest times of which there is any record, so also has it been known in other countries. It is mentioned by Hippocrates, it is described by Celsus, and reference is made to it in the old writings of China and Japan. There can be no question that the disease existed in the form not only of isolated cases but also of epidemics, in England, Scotland, France, Germany, America, and other countries of the West, long before the great Bengal epidemic of 1817 and the European epidemic of 1832 attracted so much attention to it. It is the European and American experience of cholera which is most important; it is with this that Indian experience is now to be compared, and as the first point of comparison, it is sufficient to note here the great fact that in the west cholera is not a new disease any more than it is in the East.

Ships sailing from Indian ports suffer very little from cholera;

But before examining the general history of cholera in Europe and America, the facts regarding the great link which binds India with these two continents—the facts regarding ships which sail from India to those

parts of the world—claim attention. If cholera be a disease which can be produced only in India, if its appearance in other countries be due to its having been carried to them from India, then important evidence is surely to be gained from the history of voyages between the east and west. If contact with the sick, either direct or indirect, is the great means by which cholera is spread, then ships should be specially subject to outbreaks of the disease. The facilities for taking cholera *infection* on board, if there be any such *infection*, are undeniable, for at most of the chief Indian ports cholera is always more or less prevalent, and until very recently no precautions were ever taken against it. The trade which India has had with Europe and America for years has been very large. Numerous ships have sailed to these countries from the earliest times. In olden days they were often overcrowded, filthy, and ill-ventilated; the conditions were in fact the most favourable that possibly could be for the propagatoin of cholera if modern theories regarding this mode of propagation be correct. But it is matter of common observation that, instead of having suffered severely from cholera, ships sailing from India have been remarkably exempt,—not only passenger ships and troop ships and merchant ships, but ships carrying pilgrims to Mecca, and ships carrying coolies to the West Indies and Demerara and other colonies. With rare exceptions they all tell the same story. A few cases have often occurred on leaving Calcutta, perhaps one or two in the river, or within the first few days at

sea; but when sailing from other ports directly on the seaboard, and when passage through a cholera country had not to be made, even these isolated cases have been almost unknown. Severe outbreaks even in ships sailing from Calcutta have been extremely rare.

and do not carry cholera to other countries.

Since 1842, when the Red Sea route was opened, the traffic between India and Europe has been constant; and since 1869, when the Suez Canal was opened, it has gone on increasing. Day after day, ships are passing through the canal, and the great majority of these are from Indian ports. There has thus been the most ample means of testing two great points on cholera history: *1st*, Do ships leaving India suffer from cholera as might be expected if modern views be correct? and *2nd*, Do they convey cholera from India to other countries? The answer to both these questions must be decidedly in the negative. The proportion of ships in which cholera appears at all is extremely small, and instances in which it assumes anything like the proportion of an outbreak are most rare. It is, moreover, a very important and significant fact that even during these recent years in which there has been constant, rapid, and direct communication between India and Europe *viâ* Egypt, not a single instance is to be found in which an epidemic can be shown to have been caused by the arrival of a ship from India. And what is even more remarkable still is that no attempt has been made to connect epidemics with the

arrival of ships from India except in one or two instances, and that even in them a more accurate examination of the facts has subsequently shown that no such connection was even plausible.

Cases which seem to be at variance with this view.

In 1865 the invasion of Arabia by cholera was at first attributed to an Indian vessel arriving at Jeddah, but a more careful investigation satisfied those who had made the original statement that this conclusion was not in accordance with the facts, and that the ship in question, instead of having brought cholera from India, had in reality become affected at the port of Makalla[1] in Southern Arabia, where cholera was already prevalent. The outbreak at Southampton in 1865 was attributed to the arrival of one or more of the Peninsular and Oriental Company's ships. Professor Parkes made an elaborate enquiry into the subject, but the utmost he was able to show was that the persons first attacked "were from the nature of their occupation more exposed to chances of contagion, introduced into the town and vicinity from the port, than the rest of the community, although none had had communication, direct or indirect, with the Peninsular and Oriental Company's vessels."[2] In other words, none of the many persons who must have had direct and indirect communication with these vessels, and who were therefore exposed to the great danger supposed to be

[1] Report of Medical Officer of the Privy Council. New series, No. V, 1875.

[2] Page 55.

connected with them, suffered at all. The case of the S. S. *Columbian* also deserves a passing notice. This ship was supposed to have imported cholera into Aden in the autumn of 1881. The idea was that one or more of the bags of rice which formed her cargo had been tainted with cholera discharges before leaving Bombay, that the germs of cholera were thus carried to Aden, and that these germs fastened on certain of the coolies who were employed in unloading the ship, and who were in consequence attacked by the disease. This was the explanation of the slight cholera outbreak at Aden in 1881 which was advanced by a special committee, but the explanation was not in accordance with the facts. There was no evidence that any of the rice bags had been contaminated. If they were, the fact remains that the 700 people on board between Bombay and Aden did not suffer from them, while the community to which the unloading coolies at Aden belonged, had already been suffering much from sickness before the *Columbian* arrived, and after that ship arrived cholera was chiefly localised among these Somalis.

The case of H. M. S. *Crocodile* in 1884.

The case of H. M. S. *Crocodile* is not one of any great importance in itself, but having occurred recently and at a time when Europe was alarmed at the threatenings of a new cholera invasion, it has attracted considerable attention, and has been cited as an illustration of the great danger of the disease being imported from India. The *Crocodile* left Bombay on the 3rd April 1884, having on

board 1,283 troops, including women and children. The number of the crew is not stated. The troops were nearly all from the depôt at Deolali, which is 113 miles from Bombay, but the exact number received from that depôt is not stated. From Deolali they were conveyed to Bombay by rail. A sergeant-major, who accompanied the first detachment, and embarked on the morning of the 2nd April, was found on arrival to be suffering from violent diarrhœa and died the same day. His case was returned as one of "diarrhœa with debility." But as it was suspicious, it was treated as if it had been one of undoubted cholera; his bedding, clothing, &c., were sunk in the sea, and the hospital thoroughly fumigated. There were eight cases during the voyage.[a] The position of the ship when each occurred is not stated, but they all appear to have shown themselves before reaching Malta. All those who were attacked came from Deolali except one, a man of the Army Hospital Corps, who belonged to the permanent staff on board. Of the 8 cases, 5 were in men who had been in attendance on the sick. None of the crew suffered; "they partook of the same food and water as the troops."[1] The greatest care was taken to isolate the sick and to carry out disinfection to the utmost. Although not forming part of the events on board the *Crocodile*, it is to be noted that two of the

[a]

April 6th	1
„ 10th	1
„ 15th	1
„ 16th	1
„ 17th	1
„ 19th	2
„ 20th	1
Total	8

[1] Official report.

children of the sergeant-major—the first man attacked on board the *Crocodile* with suspicious symptoms—were seized with cholera at Bombay on the 4th April. They also had come from Deolali, and were left behind when their father died. It will be observed that the cases were very few—only 8 in a population of some 1,400,—and that, with one exception, they occurred among persons who had all come from the same locality. The same remark applies to the two children who had also come from Deolali, and were attacked in Bombay instead of on board the *Crocodile*. It will naturally be urged that the cases were so few because isolation and disinfection were so carefully practised; but, as already remarked, isolation and disinfection have never stopped an outbreak on shore, and cannot therefore be credited with the results on boardship; and, moreover, the experience of the *Crocodile* in respect of the limited number of attacks is but a repetition of the experience of hundreds of other vessels in which without any such measures cholera has been limited to a few cases. It may indeed be questioned whether the isolation and disinfection, although very properly taken, did not do harm by inducing a dread of the disease. "It was too evident," says the report," that there was a feeling of alarm among the troops, as they refused to volunteer when called on to do so to aid the sufferers." Although disinfection and isolation are powerless to check an outbreak, there can be no doubt of the mischievous influence of fear, in rendering men more liable to attack. Of the antecedents

of the man of the Army Hospital Corps who was attacked nothing is said except that he had been on shore the day before the *Crocodile* left Bombay. Importance may be attached to his case from the fact that he was the only person attacked on board who had not come from Deolali, but in the absence of full details much weight cannot be attached to this. Others again may think that when persons in attendance on the sick are attacked this is quite sufficient to shew that the attack was due to *infection* arising from attendance, but such a conclusion is not only illogical but opposed to the teaching of experience.

Practical conclusions to be drawn from the case of the *Crocodile* and other ships.

So far from the *Crocodile* being an illustration of the danger of ships from India conveying cholera, it is merely a fresh illustration of how rarely any cases of cholera occur on board ships sailing from Bombay, and how little danger there is of a severe outbreak taking place on board them. No doubt there are instances of severe outbreaks of cholera on board ships, and these will be referred to subsequently. The points to be noted now in the general history of cholera on board ships sailing from Indian ports are, that on board such ships cases of cholera are rare, that when they do occur they are generally limited in number and confined to persons who had come from a particular locality, and that no single instance can be produced in which a ship from India has carried cholera and produced an outbreak, still less an epidemic, in another country. If ships from India were the com-

mon carriers of cholera, as they ought to be according to the opinions usually accepted, then there should be no difficulty in producing, not one or two doubtful instances in which the evidence breaks down at once on examination, but hundred of instances in which the evidence is clear, complete, and incontrovertible.

General summary of the history of cholera in Europe and America during the last 55 years; and first regarding the period 1829 to 1864; the epidemic of 1829 to 1837.

Leaving ships, the great facts regarding cholera in countries out of India must now be considered. It is not possible to consider, or even attempt to consider, the complete history of cholera outside of India. In regard to many countries there is practically little or no information to be had; in regard to others it is often vague and unsatisfactory. The object in view is not to write a history of cholera, but merely to illustrate some of the great truths regarding it. For this purpose a very short summary of the events of the last 55 years from 1829 to 1883 will suffice, and this may with advantage be restricted to Europe and America, regarding which the information is more complete than it is regarding other parts of the world. Since 1829—and it is not necessary to go further back than this—the time may be conveniently divided into three periods. First there is the period between 1829 and 1864; then there is the period from 1865 to 1880; and thirdly, the period from 1880 up to the present date—October 1884. In the first of these periods, there were three great epidemics of cholera in Europe and America: the epidemic which commenced in 1829 and

lasted till 1837; the epidemic which commenced in 1847 and lasted till 1851; and the epidemic which commenced in 1852 and ended in 1855. All three epidemics appeared first in the east of Russia; the first was the most prolonged, the second was the most powerful in its intensity, and the third the most rapid in its progress. The epidemic of 1829 to 1837 was first heard of at Orenburg in Eastern Russia in August of 1829. In 1830 it advanced to Novgorod, Moscow, and Odessa. In 1831 it advanced still further westward all over Russia, attacked Sweden, Germany, Austria, Hungary and Turkey, and appeared in England at Sunderland in the end of October. In 1832 it attacked France, England, Scotland, and Ireland, and crossed over to America, appearing at Quebec on the 8th June, Montreal on the 10th June, New York on the 23rd June, and Philadelphia on the 5th July. In 1833 Spain was invaded for the first time in the epidemic, and most of the countries which had suffered in 1832 suffered again, but with less severity. In 1834 Spain continued to suffer. In 1835 the south of France was attacked, and particularly Marseilles and Toulon. In August the north of Italy was attacked. In 1836 the epidemic was over Italy generally. It appeared at Milan in April and at Naples in October. In 1837 Malta and Palestine were attacked.

Epidemic of 1847 to 1851.

The disease in epidemic form was not heard of again in Europe till 1847, when it appeared at Orenburg in August. It advanced as far as Moscow and Constantinople,

and a few isolated cases occurred in Britain and France. In 1848 the whole of Russia Poland, and Sweden were attacked. It was at Berlin in July, in Holland in September, London in September, Edinburgh in October, Belfast in December, and in America on the 2nd December. In 1849 the greater part of Europe and America suffered, and many places with great severity. In 1850 Egypt was attacked; also Malta, Gozo, Mexico, California, Cuba, and Jamaica. In 1851 there were only isolated outbreaks in Poland, Silesia, and Pomerania.

Epidemic of 1852 to 1855.

The epidemic of 1852–55 seems to have commenced with cases in East Russia, Prussia, and Poland. In 1853 Russia, Denmark, Norway, England, Hanover, Holland, and France were attacked. London suffered in September and October. Towards the end of the year the disease appeared in America, in Mexico, and in the West India Islands. In 1854 nearly every part of both the Old and New World was under the influence of the epidemic, and in 1855 the same was still true, though in a minor degree. From 1856 to 1858 there is no record of cholera in Europe or America, but in 1859 it reappeared in Hamburg, in several towns of the Gulf of Finland, in Algiers and in Morocco; and a few cases occurred in England, chiefly in London and Hull. From that year up to 1864 there was again a lull.

Cholera in Europe and America 1865-1879.

The history of cholera in Europe from 1865-80 has been given by Mr. Netten Radcliffe, and from his re-

ports[1] the following dates regarding the appearance of cholera at certain places and other facts are taken :—

1865.—Suez, 21st May; Alexandria, 2nd June; Marseilles, 18th June; Malta, 20th June; Constantinople, 28th June; Ancona, 7th July; Gibraltar, 18th July; Kustendji, August 2nd; Odessa, August 10th; Kertch, August 29th; England, September 17th [confined to two local outbreaks, one at Southampton and the other in the parish of Theydon Bois in Essex]; Paris, 18th September; Naples, October 6th. Reached the United States in November.

1866.—Was prevalent over nearly all Europe, including the United Kingdom and America.

1867.—Continued more or less prevalent in many parts of Europe and America, and invaded Switzerland.

1868.—Epidemic was confined to two localities in Europe, a district in the province of Kiev in Russia, and a valley in Essen in Germany.

1869.—Eleven governments of European Russia affected.

1870.—Thirty-seven governments of European Russia affected.

1871.—Generally diffused throughout Russia; in Poland also there was a severe epidemic—126,937 persons died. Prussia suffered to a considerable extent, and also Sweden.

[1] Report of the Medical Officer of the Local Government Board, new series, V; and Transactions of the Epidemiological Society, Volume IV, Part IV.

1872.—Again widely spread over European Russia, causing 113,196 deaths. Poland, East Prussia, Silesia, Roumania, and Gallicia were also invaded.

1873.—Reappeared in 14 of the governments of European Russia—the number of deaths fell to 4,395; but in Poland the epidemic was very severe, causing 29,733 deaths. In Austria there were 103,721 deaths. In Hungary, Roumania, and Turkey there was some prevalence. In Prussia 23,242 persons died; several towns of Bavaria, including Munich, suffered. Belgium and France also suffered, but not severely so far as can be ascertained. In England some cases occurred, but they were all supposed to be imported cases.

1874.—Seriously present in parts of Central Europe, especially in Hungary. In 1875, 1876, and 1877 there is no notice of any cholera in Europe. In 1878 it was reported to have broken out at Voronej, a place 300 miles south of Moscow, and to have attacked 60 persons. The year 1879, again, is blank. In 1880 it was reported at Saratov on the Volga, and 700 soldiers are said to have been attacked at Orel in Central Russia.

In the period 1880 to 1884; the present epidemic.

Since 1880 the facts are all of importance as bearing on the history of the epidemic now in Europe. On the 3rd August 1881 the disease broke out at Aden, and 30 persons were attacked. In September cases appeared among the pilgrims at Mecca.

1882.—Again prevalent at Mecca and Jeddah.

1883.—Appeared at Chiappa in Mexico.[1] On the 23rd June first case reported in Egypt at the decayed port of Damietta on the Mediterranean. On the 2nd July a case occurred at Alexandria, and on the 15th it appeared at Cairo. Alexandria suffered little, but the epidemic was severe in other parts of Egypt, and there was an outbreak the among British troops at Suez.

1884.—The information regarding the cholera epidemic now in Europe is still very meagre. The following are the chief facts which are yet known : 23rd June, cases reported at Toulon; 28th June, reported at Marseilles ; 30th June, a death from cholera at Rome ; 8th July, deaths at Alexandria ; 11th July, a case at Paris ; 12th July, reported at Lyons; 14th July, a case at Alexandria ; 19th July, a few cases at Arles and Nismes ; 21st July, 8 deaths in Paris ; 26th July, reported at Spezzia ; 30th July, a mild outbreak at St. Petersburgh and Charkoff ; 2nd August, slowly spreading throughout Italy ; 20th August, a few cases in Birmingham ; 22nd August, reported at Geneva, Milan, Turin and Genoa ; 25th August, increasing in Italy, military cordons established ; 29th August, broke out at Naples ; 3rd September, broke out at Alicante in Spain ; 4th September, 100 cases daily in Naples ; 8th September, 451 cases to-day in Naples, and 154 fatal; 11th September, 937 cases in Naples, 365 fatal ; 15th September, cholera decreasing at Naples.

[1] "Lancet," 3rd February 1883.

During fifty-five years places in most direct and constant communication with India have suffered least.

Such are the main facts regarding cholera movement in Europe and America since 1829. What are the general conclusions which the experience of the fifty-five years warrant? If cholera really be spread by human intercourse which conveys the disease from India to other countries, it cannot be difficult to establish a clear and definite relation between the great routes of traffic from India to Europe and the general history of cholera extension. Do the facts show any such relation? Have the places which are in the most constant and rapid communication with India suffered more frequently than others which are off the main route, or have epidemics moved along the main lines of communication more rapidly than along the slower and more unfrequented routes? The dangers of direct and constant traffic and the facilities for the introduction of cholera thus afforded of late years have been frequently insisted on by writers on cholera. Have these fears been realised? It will be remembered that the Red Sea route was opened in 1842, and that in 1869, when the Suez Canal was completed, a vast extension took place in the traffic along this route. For years now the Cape route has been almost deserted, and communications and commerce between India and Europe have been carried on *viâ* Egypt. Has Aden, which is within a few days' sail of India, suffered in consequence? It suffered in 1865, and again to a slight extent in 1867 and in 1881. That is to say, notwithstanding most frequent and

rapid intercourse with India, Aden since 1865 has suffered three times during the last nineteen years during which the Red Sea route has been in use. Only twice has it suffered during the last fifteen years since the Suez Canal opened, and both times very slightly. Yet Aden is on the highway of Indian commerce. Moreover, it is situate at the point of greatest theoretical danger, because it is nearest to India. And what has been the history of Egypt during the same period? It has been a history of equally striking immunity. In 1850 Egypt suffered from cholera in the extension of the epidemic which entered Europe *viâ* Russia. In 1865 it suffered again, and then in spite of all the Indian traffic it remained free for eighteen years till 1883. And while there has been this marked immunity along the highway of communication between India and Europe, what has been the experience of places in Europe removed from this highway? The epidemic of 1852 to 1855 invaded Europe through Russia, just as the epidemics of 1829 and 1847 had done. The Red Sea route made no difference in the route taken by this cholera. During the twenty years since 1865, as already shown, Egypt and Aden have both suffered on three occasions. During the same period, one or other part of Europe has suffered on at least thirteen occasions, and on several of these the epidemic was general over great part of the Continent. East Russia and other parts of Europe, remote as they are from India and Indian traffic, have suffered many times oftener and more severely

from cholera than Aden, which is but a week's sail from India, and has been in daily communication with India for many years.

Since direct and constant communication was established between India and Europe, Europe has suffered from cholera invasion less frequently than it did before.

Or to apply another test—since the East and West have been in more direct and constant communication, has Europe suffered more frequently from cholera epidemics than it did previously? The facts during the last fifty-five years stand thus:

Epidemic invading Europe in	1829
Interval of 17 years	1830–1846
Epidemic invading Europe in	1847
Interval of 4 years	1848–1851
Epidemic invading Europe in	1852
Interval of 12 years	1853–1864
Epidemic invading Europe in	1865
Interval of 18 years,	1866–1883
Epidemic invading Europe in	1884

The foregoing may be divided into two periods, the first extending from 1829 to 1852, or twenty-four years, when there was little or no communication *viâ* the Red Sea, and no suspicion that cholera was ever introduced into Europe along this route. During this time there were two epidemics,—one after an interval of seventeen years, and the other after an interval of only four years. During the second period of thirty-two years, when communication became direct and rapidly increasing, there were also two epidemics in Europe,—one after an interval of twelve years, and the other after an interval of eighteen years. The latter

period is more favourable than the former, and the last interval during which direct traffic with India has been many times greater than it ever was before, is the longest period of exemption from new invasion which Europe has enjoyed during the last fifty-five years; or, in other words, the longest interval on record.

In spite of railways and all the other improved means of communication, the present European epidemic travels no faster than did that of 1832.

Since 1829, when cholera first attacked Europe as an epidemic of modern times, the means of communication have enormously improved. What with steamers and railways, people can now travel much faster than they did, and hundreds travel now-a-days for every one that used to travel in olden times. In this respect there has been a vast change during the last fifty-five years. But does an epidemic travel to Europe any faster than it did? Certainly not. The present epidemic appeared in Egypt on the 23rd June 1883. In all probability it was there earlier, but the first case in Europe was not reported till the 2nd June 1884—a whole year afterwards.

The extension of cholera in Europe and America has never borne any relation to the means of communication existing at the time.

As a matter of fact, there is no relation and never has been any relation between the pace at which cholera extended in Europe or America and the means of communication existing at the time. An examination of any of the epidemics will illustrate this truth. Even in 1832, when the means of travel were comparatively slow,

it cannot be asserted that it took two years for ordinary traffic to go from Orenburg to Berlin, or nearly four years for it to go from Berlin to Northern Italy. Cholera, moreover, has not moved more rapidly from one place to another where the means of travel have been quick, than between places where the means of travel have been slow. Nor since railways have increased, and it has been easy to go from one end of Europe to the other in as many hours as it formerly took days, has cholera extended at all more rapidly than it did. Dr. Akhangelsky remarks regarding the Russian cholera of 1870: "Notwithstanding the considerable network of railway communications and the great extension of steam navigation on the rivers, cholera spread itself very gradually;" [1] and the same has been the general experience of other countries. As has already been shown, cholera was in East Russia and Central Europe many years without advancing further, although railways extended in every direction, and theoretically it might in a few hours have been conveyed to any capital in Europe. Similar was the experience of Egypt in 1883. There for a whole year cholera was stayed, and there was no extension either by land or sea. It may be said that the epidemic was arrested by quarantine, but the fact that the exemption was general, and that countries in which there was no quarantine suffered from cholera no more than those which had quarantine, is sufficient evidence to show that the restrictive measures had no influence

[1] Quoted by Radcliffe, p. 131.

on the results. The real truth is, and it is a truth which is exemplified both in India and elsewhere, that although the first manifestation of an epidemic is often by leaps and bounds over great distances, the steady onward progress of the main body of the epidemic itself is, as a rule, much slower than the ordinary progress of human intercourse even in those days when such intercourse was very much slower than it is now.

Even in temperate countries there is a distinct relation between season and cholera prevalence.

Although cholera has occurred in European countries at all times of the year, it is by no means independent of season. In England it has usually been most severe in the autumn, at the time when diarrhœa is most apt to prevail. The following extract on the subject from a recent paper by Professor Pettenkofer[1] is of much interest and importance.

"In proof of the existence of a powerful seasonal factor in connection with cholera, I can adduce no more instructive example than that of the seasonal occurrence of the disease in the kingdom of Prussia from the year 1848 to 1860. During that period cases of cholera occurred every year, although of different strength and in different provinces. Brauser has collected all the ascertained cases occurring during the period and arranged them according to months. Of the fatal cases during these 13 years,

112	occurred	in	April.
446	„	„	May.
4,392	„	„	June.
8,480	„	„	July.

[1] Published in the "Latest News," Munich, 1884.

33,640	occurred in	August.
56,561	„ „	September.
35,271	„ „	October.
17,630	„ „	November.
7,254	„ „	December.
2,317	„ „	January.
842	„ „	February.
214	„ „	March.

In the face of such a fact, which is independent of any theoretical consideration,—in the face of this astounding regularity in the rise and fall in number of cases according to months,—one may well feel constrained to take the seasonal element into account, and to assume the dependence of cholera and the infecting cholera fungus on a seasonal element as well as on locality."

Many places have escaped and others have suffered in varying proportion.

In Europe, as in India, the countries invaded by cholera are not universally attacked, nor do the different places suffer at all in the same proportion. Many places escape altogether, others suffer little, and others suffer a great deal. The information of this kind which is contained in the reports of epidemics which have occurred out of India is often very defective, but there can be no doubt of this general truth. In their report on epidemic cholera in England which was published in 1854, Drs. Baly and Gull observe[1]: "Of the characters here referred to, the most obvious one is the unequal and very partial distribution of the epidemic. . . . Cholera left whole districts unvisited, and has fallen severely on comparatively few localities. The unequal and partial

[1] Page 7

distribution of the cholera epidemic is manifest, whether Europe is regarded as a whole, or the attention is confined to this country alone, or even to a single town or a single public institution. . . . . Four-fifths of the deaths from cholera in England and Wales during the year 1849 (namely, 46,592 out of 53,293 deaths) occurred in 134 registration districts, the total number of districts being 623; on the other hand, there are 85 districts in which no death was caused by cholera, ... The mortality caused by cholera was considerable in a comparatively small number of places, while over the general surface of the country no deaths were caused by it, or only single deaths." In American epidemics experience has been to the same effect. The violence of the epidemic of 1873, for example, fell on the valley of the Mississipi, though exact data are wanting, and it is not possible to learn from the official report,[1] large as it is, such simple and important facts regarding each State as the population at the time, the number of towns and villages, the number of these attacked, the number of persons attacked, the number of deaths, or how the epidemic was distributed as regards time and season.

Quarantines and cordons have altogether failed to afford any protection.

The next point to be observed is that in both Europe and America quarantines and cordons have entirely failed to afford the smallest protection. Of this there has been abundant evidence, times

[1] Cholera Epidemic of 1873 in the United States, 1875; 1,025 pages.

without number, in Russia, Sweden, France, Spain, Italy, Gibraltar, Malta, Egypt, the United States, and other countries. During the epidemic of 1866, it is alleged that the Island of Sicily escaped because of the great stringency of the quarantine in its ports, and that the disease appeared there only when, in consequence of an insurrection at Palermo, it was necessary to send troops and break the quarantine. In cases of this kind there is ample room for fallacy. Many places have escaped when they had no quarantine, and it is therefore somewhat hasty to ascribe the escape of any place to the mere fact that it had quarantine. The case of the military station of Jullundur in the Punjab in 1881 is instructive on this point. In that year the local authorities, contrary to the regulations, imposed quarantine for the protection of the cantonment. The orders were countermanded by His Excellency the Commander-in-Chief, and the quarantine was withdrawn. The disease was very prevalent in the town and neighbourhood of Jullundur, but the cantonment almost wholly escaped. Had the quarantine restrictions been sanctioned in this instance, the exemption of the cantonment would without doubt have been attributed to the action of the local authorities, and the case would have been cited as evidence of the value of quarantine as a protection against cholera. Recent events in Egypt, France, and Italy have again demonstrated that quarantine is no protection against the entrance of an epidemic.

And while these measures have done no good whatever, there is no doubt as to the harm they have done. They have paralysed trade; they have aided materially in producing an unreasoning panic, thereby rendering the people more prone to attack; and they have diverted the public money and the public attention from the real evils to be remedied—the filth and overcrowding of towns and villages, and the other grossly insanitary conditions in the middle of which the people live, and which all aid in favouring disease. What has Egypt, or France, or Italy, or Spain, in this epidemic now going on, to show in return for all the worry and annoyance and the serious falling off in trade which they have suffered? In what respect have they been better off than England, or Scotland, or Ireland? Have these measures delayed the attack, or will they suffer less severely? So far they have gained nothing, and are much worse off than any of the countries which have set aside quarantine as an absurdity. No one has in fact derived the smallest advantage from quarantine except the quarantine officials. They have benefited largely, not only during the time of danger, but also prospectively, because it is only by their activity at such a time and their pretence of staying the epidemic that their existence can be justified. They have benefited, but they have benefited at the expense of the prosperity, the comfort, the convenience, and in many instances the social happiness of the public by whom they are paid.

and have done much mischief.

The suggested quarantine at the entrance to the Red Sea could be of no use.

It has been argued that no quarantine at Suez or in European ports can ever be effectual, that what is really wanted to protect the west from cholera is a strict quarantine station at the entrance to the Red Sea, and that here all ships coming from India should be most searchingly dealt with. This was in effect one of the main proposals of the Vienna Cholera Conference in 1874. There seems no good ground for supposing that quarantine at the entrance to the Red Sea could be more successful than in any other place. The whole proposal rests on a series of assumptions. It is assumed, *first*, that a cholera epidemic is dependent for its movement on the movement of human beings; *secondly*, that it is possible by means of quarantine to check the advance of cholera; and *thirdly*, that the main, if not the only, road along which cholera is conveyed from India to Europe is the highway of traffic *viâ* the Red Sea. Whatever opinions may be held on the first of these points, the second and third are matters of experience, which admit of no difference of opinion. It has been proved beyond all manner of doubt that quarantine cannot stop the progress of cholera. And it has also been shown that of the five epidemics which have invaded Europe during the last fifty-five years, three have beyond all question invaded, not by way of the Red Sea, but by way of Russia; and that the fourth, although it first appeared in Egypt, cannot be traced or connected in any way with the arrival of a ship from India. All the evidence goes to prove

that it was not conveyed by any such means. Even if quarantine were theoretically correct, the guarding one small neck of sea, as if it were the only passage to Europe, would be very much as if a general were to hold a bridge over a river with a strong force, but to leave many miles of its course, fordable throughout, altogether unguarded and open to the enemy. Moreover, as has been already shown, cholera during the last twenty years has been in Russia more or less nearly every year. There is reason to believe that, if the truth were known, it would be found to be persistently present there every autumn, if not at other seasons. With the evidence already adduced in regard to cholera in Russia, what advantage can be gained by quarantine at the entrance of the Red Sea?

Isolation of sick and disinfection of discharges have failed to stop cholera outbreaks.

As quarantine cannot stop the course of a cholera epidemic, so isolation of the sick and disinfection of cholera discharges have shown themselves as powerless to stop a cholera outbreak in Europe as they are in India. The two proceed on the same assumptions that the evacuations of cholera patients contain the deadly poison or germ of the disease, and that all contact with them is most dangerous. On this point the following extract from a paper by Professor Pettenkofer in the Munich "Latest News" during the current year is of much interest. The opinion of Professor Pettenkofer is the more valuable because he is a staunch believer in the doctrine that cholera is spread by human intercourse.

"In the Laufen jail the fluid contents of the cesspools were under other circumstances pumped out several times monthly and spread out on the fields. When the epidemic broke out[1] this was at first, in due care against danger to public health, put a stop to. But as at this time not only was there a great increase in the amount of excreta, but as with the increase in the number of cases of disease, a greatly increased amount of fluid entered the latrines, the whole of the cesspools became full almost to overflowing. The fluid contents of the northern cesspool found their way at this time into the cellar, into which they dropped down along the walls and from the vault, so that wooden vessels were placed below to catch them. Public opinion and sanitary considerations were opposed to the design of emptying the cesspools and removing the material. No one would undertake the formidable operation, and no one would allow the dreaded material to be brought through their streets and on to their land. It was debated in the sanitary council whether at all events the fluid part of the material after disinfection might not be thrown into the rapidly-flowing Salzach; but as disaster might have originated from the insufficient disinfection of the cesspools, this was not carried out, and specially on this account, that the Salzach in its course from the jail almost surrounds the town of Laufen; and as according to common opinion the wells in Laufen are only fed by filtering of water from the Salzach, the apprehension of poisoning all the wells of the town necessarily arose. At the same time it was impossible to allow the jail to remain any longer drowned in its own nauseous juices. Necessity is the mother of invention, and so ways and means for the removal of the obnoxious materials were devised. The prohibition of removal was rescinded, places were fixed on whither the fluid and

[1] It was very severe. Out of 522 prisoners, 128 were attacked within two weeks and 83 died.

solid filth should be transported, and eventually three courageous peasants were found who were willing to weigh their lives against good money and good manure, and the six cesspits of the jail were emptied and their contents removed from it and from the town during the nights of the 17th and 18th and 18th and 19th December 1873, between the hours of midnight and 6 A.M. Seventy-five loads were thus removed, which, taking a load as only amounting to twenty hundredweight, is equivalent to 1,500 hundredweight. The emptying of the cesspits and filling of the vessels for removal was carried out by eight prisoners, who volunteered for the service, and four men from the town (the gravedigger Fuchs and three assistants). In addition four carriers were engaged in the transport, who were sent by the contracting peasants. I certainly was not an eye-witness, but it appeared subsequently that all the vessels were not hermetically closed. It has been ascertained that not one of these individuals, who came into the closest relation with the cholera excreta, suffered from cholera, cholerine or diarrhœa, and that neither in the neighbourhood of Laufen nor in that of the site of the deposit of the materials did any further diffusion of cholera occur."

In another passage of the same article Professor Pettenkofer remarks that "the uselessness of measures for disinfection on the one hand and the harmlessness of non-disinfected choleraic excreta on the other have demonstrated themselves to me with constantly increased clearness."

Quarantine is based on the belief that every person suffering from cholera in even its mildest form is multiplying within him and giving out innumerable germs, and that a ship with everything it contains may also be bear-

The system of "medical inspection," though useful, is not to be depended on as a means of preventing cholera invasion.

ers of these germs which act as centres of fresh infection. If this belief be correct, then quarantine is a very logical outcome of it. It may not be possible to keep out all these sources of danger, but every one that is kept out must be a decided gain. Many, however, who hold the belief above expressed are yet of opinion that quarantine is an impossibility. This view obtains largely in England, and there a system of *medical inspection* of new arrivals, as it is called, has been instituted—a system under which ships from suspected ports are inspected, and any persons sick of cholera detained in hospitals set apart for the purpose. The system is very right and proper; it can do no harm, and it is a decided boon to those who have had the misfortune to be attacked. But *medical inspection* can no more defend a country from cholera invasion than quarantine can. Indeed, if the belief on which they both rest be correct, then in theory quarantine is more likely to be effectual than *medical inspection*. But, as has been already shown, quarantine has signally failed, and no dependence is therefore to be placed on medical inspection. Ships coming from cholera-stricken places may be expected to have cholera sick on board, and several instances of the kind have recently occurred in ships coming from Marseilles to England. The sick have suffered because of the influence of the place from which they have come, and the best evidence of the groundlessness of the fear attaching to them is to be found in the fact that in nearly every instance they are isolated cases, and the rest of the ship's crew have not

been attacked. There is a great difference, as will be explained in a subsequent chapter, between the arrival of persons suffering from cholera and the arrival of the influence or causes which produce cholera.

Isolated cases of cholera occur in all countries every year.

Quarantine is not unfrequently imposed after the country concerned has shown unmistakeable signs that it has already been invaded by cholera. This was the case in 1883, when Egypt continued to quarantine India, although it was itself suffering from a severe epidemic; and England is now carrying on a system of medical inspection when there is the strongest ground for believing, as shown by the increase in diarrhœa deaths, by outbreaks of what is called *English cholera*, and by isolated cases of undoubted cholera, that the disease has already obtained a footing in the country. Under such circumstances, both quarantine and *medical inspection* as means of defence are altogether illogical, but in regard to both these systems at all times is there not the still stronger argument that in all countries isolated cases of true cholera occur every year? Such cases are to be found, especially in the autumn months, when diarrhœa is most prevalent. But these, it is said, are not cases of *Asiatic cholera;* they are cases of *English cholera* or *cholera nostras.* In severe attacks there is no difference between the two. The symptoms are the same, the end is often the same. The *Lancet* of the 29th September 1883 contains an account of two typical cases of this kind. Two men died at Sligo in Ireland, one on the 19th and the other on the 21st September, after eight hours' illness.

The symptoms were collapse, suppression of urine, and rice-water evacuations. From the description no one in India would have hesitated to pronounce them undoubted cases of cholera, but in England they and many others of a like kind are recorded as cases of *English cholera* or *cholera nostras*. If they were admitted to be cases of real cholera such as are to be seen in epidemics, the whole theory of human intercourse must fall to the ground. It would then virtually be admitted that cholera need not come from India, that although the causes which produce cholera are more persistently and strongly present in India than elsewhere, they are ever present in a very minor degree in other countries, and only require intensifying to manifest themselves, not only in isolated cases, but in numerous cases; in other words, to become epidemic. These cases of so-called *cholera nostras* lie indeed at the root of the whole question. Are isolated cases of small-pox or measles different from the numerous cases which make up an epidemic? Are they distinguished as cases of *variola nostras* or *rubeola nostras?* And yet these diseases, just like cholera, have their times of abeyance when they present themselves in solitary attacks, and their times of epidemic prevalence.

Diarrhœa is frequently prevalent before cholera appears.

There are many other facts in the experience of Europe and America in respect of cholera which might be noted and compared with what has been observed in India, such as the different severity of different epidemics, the simultaneous rise and fall of the disease in different places, the difficulty of explaining the

cessation and complete disappearance of an epidemic on any theory of human intercourse and the experience of attendants on the sick as bearing very directly on this belief as to the way in which extension of cholera takes place. But it will suffice to draw attention to one other point, and that is to the frequent existence of diarrhœa prevalence not only during an outbreak of cholera, but before any cases of an undoubted cholera epidemic have appeared. An instance of this kind is recorded by Mr. Netten Radcliffe in regard to New York[1] in 1865, and numerous other instances might be cited to the same effect. Speaking of the outbreak in New York in 1865, he says, "The appearance of cholera had been preceded by much diarrhœa and dysentery."

The great facts regarding cholera in Europe and America are quite in accordance with Indian experience.

In Europe and America, so far as is known, there is no endemic area in which cholera is always more or less prevalent, unless the east of Russia on further enquiry be found to bear this character; but in all other respects the experience of these countries, as indicated by the great facts of the last fifty-five years, are in entire accord with those which are observed in India, and which have been stated in the previous chapter.

They show,—

1st,—that cholera has been known in other countries from the earliest years, and that isolated cases occur every year in all countries more or less;

[1] *Op. cit.*, p. 88.

2nd,—that ships do not carry cholera from India to other countries;

3rd,—that countries in most direct and constant communication with India have suffered least;

4th,—that since there has been more direct, constant, and rapid intercourse with India, Western countries have suffered no more than they did before;

5th,—that there is no relation between the facilities of communication and the progress of an epidemic;

6th,—that quarantine and medical inspection, cordons, isolation of the sick and disinfection, have afforded no protection;

7th,—that while these measures have done no good, they have done much harm by paralysing trade, by inspiring an unreasoning panic, and by diverting men's minds and public money from sanitary improvements; and

8th,—that by sanitary improvements alone can the unknown cause or causes which produce cholera be counteracted—cuuses which are never entirely absent, as evidenced by isolated cases, but which show themselves in epidemic force only at uncertain intervals.

CHAPTER III.

The Theories which have been Advanced Regarding Cholera Examined in the Light of the Facts Recorded in the two Preceding Chapters.

The great facts are opposed to the opinion that the extension of cholera is due to human intercourse.

Such, then, are some of the great facts regarding cholera, as illustrated in the recent experience of India and in the experience of other countries, more especially of Europe and America, during the last fifty-five years. It must be admitted that they are of vast importance, and that they have an unmistakeable significance. Either they are true—they are really facts; or they are false—not facts, but a mere delusion. If they are all a delusion, let the errors be pointed out and let the truth be recorded; but if they are true, then they cannot be set aside. It will not suffice to say that the theory of human intercourse has been established beyond all dispute, and that there is no need of considering the question any further. Great facts like those recorded in the two preceding chapters, telling the same story year after year, are not to be ignored, nor is their teaching to be disregarded. Still less are mere theories to be weighed against these facts. For years now the upholders of the doctrine of the spread of cholera by human intercourse, and by human intercourse alone, have advanced opinions as to what may be expected

from the recently increased and much more rapid intercourse between India and England ; and in obedience to these theories, the restrictions laid on commerce and on travellers in the shape of quarantine and other measures of interference have been made more and more stringent, till they have become a grievous burden. But the events which have actually happened, as already shown, give a direct and most decided negative to all these opinions, and that in a manner which is as striking as it well could be. The world in this matter has been ruled and oppressed by theories, and the experience of recent years has shown that the great facts of cholera distribution are diametrically opposed to them.

Stories of seeming importation of cholera are frequently adduced—often very vague.

But it will certainly be urged that there is a whole body of evidence which has not yet been touched, and which is all in favour of the commonly received ideas that there are innumerable instances of cholera having been imported into places and of the disease having been caused by this means, and that such examples have been often met with both in India and in other countries. Without doubt innumerable instances of this kind have been cited and are being constantly cited. But those who have been accustomed to investigate the history of great epidemics and the details of outbreaks in particular places are well aware of the many fallacies which surround evidence of this kind. The difficulties of getting at the whole truth are indeed very great and often prove insuperable. There

are so many factors at work, so many important points on which information is apt to be lost, that there is nothing in the way of medical and sanitary enquiry more difficult than to ascertain the real and full details of a cholera outbreak. In many cases the stories are so vague as to be of no value. The first case is said to have been an arrival from a cholera-affected place. In many instances nothing more happens and the disease is limited to the one case, and yet this case is advanced as evidence in favour of the human intercourse doctrine. No one doubts that a person exposed to unhealthy influences in any place may not show the ill-results until after he has left that place, but this is no evidence that he imports those unhealthy influences. Where attacks are limited to new arrivals from an affected locality, the evidence, so far as it goes, is against the doctrine of human intercourse. In other numerous instances the attacks are not limited to the new arrival; others suffer, and the commencement of the outbreak is attributed to the new arrival. But often no dates are given, and even when they are given, no connection of any kind, direct or indirect, can be established between the new arrival and the cases which followed. Many reporters seem to think that this is a matter of no consequence. It is quite sufficient to show that the first person attacked was an arrival from a cholera-affected place, and that after that the outbreak began. Similarly vague stories have been told regarding persons having washed the clothes of cholera sick in tanks or by the sides of wells, and of

outbreaks having ensued, but they are all wanting in accurate detail and break down completely on cross-examination.

And open to numerous fallacies. The influence of locality is often ignored.

Even where there appears at first sight a connection between the so-called imported cases and the commencement of the outbreak, the sources of error and the dangers of drawing hasty conclusions are very great. First of all there is this fallacy, that perhaps the new arrival has suffered, not from the place whence he came, but from the place where he has arrived. The causes producing the disease are there before him, and he has suffered because he has come under their influence suddenly instead of gradually as has happened to the ordinary residents. It may be that there has been no sign of cholera before his arrival, or that no such sign has attracted attention, but very often there have been unmistakeable signs, such as unusual prevalence of diarrhœa, and, it may be, cases of mild cholera. Under such circumstances the importation theory falls to the ground. In the second place, among the cases of seeming importation which are cited, the time which elapsed between the attack of the new arrival, whom we may call A, and of the resident, whom we may call B, is often so short as to show that the one attack cannot have been due to the other. A is attacked and then within a few hours B is attacked, and the two events come in such striking connection that the relation between the two is at once assumed to be without doubt one of cause and effect.

But the interval is too short—so short, indeed, very often as to leave little doubt that B could not have contracted the disease from A, but that both A and B must have contracted it from a common cause. In the third place, the influence of locality is frequently altogether ignored. If A, B, C, and D are attacked one after another in the same place, it is assumed as a matter about which there can be no dispute that they contracted the disease one from another. But they have all been under similar influences, and is it strange that they should suffer in a similar way? If A, B, C, and D in a besieged fort were wounded one after another at irregular intervals, would it for a moment be imagined that B, C, and D were wounded on, say, the 13th, 15th, and 16th of a month, because A had been wounded on the 12th? The illustration may appear ridiculous, but it is more apt than it may seem to be at first sight, for experience has shown that if B, C, and D had been removed to another locality, they would in all probability have escaped cholera, just as they would have escaped being wounded if they had been withdrawn to some other place away from the enemy's fire.

They are for the most part one-sided.

There is still one other and most fatal objection to the evidence which has been advanced in favour of the importation doctrine, and that is that the cases adduced are all on the one side. The instances which favour the importation theory are cited, but the instances which tell against it are not recorded. The instances in which A

suffers and then B suffers are all set down, but the far more numerous instances in which A suffers and no one else suffers are left out of account. Is there any field of enquiry in which such a mode of dealing with evidence can be justified? If the truth is to be ascertained, all the facts must be examined, both those which tell in favor of a theory and those which tell against it—not those merely which are in favour of it. It is argued that all the cases in which B's attack follows A's attack are positive evidence, while all those in which B is not attacked are negative evidence. But no such distinction can be admitted. At the best they both constitute but circumstantial evidence—events which, in the present state of our knowledge, bear no relation to one another except the relation of time. If the facts on one side only are considered to be evidence, it would be possible to prove almost anything. It might be proved, for example, that in England in olden days the frost always travelled by mail coach. There were numerous instances in which the setting in of the frost and the arrival of the mail coach were contemporaneous. According to the ordinary method of dealing with medical evidence, all that would be necessary in order to prove that the coach really did bring the frost, would be to cite the number of instances in which the two events followed one another, and leave out all the instances in which they did not follow one another. It may be said that no one would argue in such a foolish way as this, but this is exactly what

is done in regard to the supposed spread of cholera by means of human intercourse.[1]

When what are supposed to be little facts are at variance with the general history of cholera they must be wrong.

No doubt, however, there have been instances which have been carefully investigated, and in which the facts, so far as they are known, favour the idea of contagion. But here again there are points of great importance which demand attention. Among these the influence of fear takes a prominent place. If a person be imbued with the belief that coming in contact with a case of cholera really involves great danger, it is obvious that the chances of his being attacked are much increased. And in addition there is always this element of error, that all the facts can never be fully ascertained, and some little fact, at first unknown or utterly disregarded, has often sufficed to show that the conclusions which had been drawn before this little fact was ascertained are incorrect. Moreover, allowance must be made for coincidences which are so frequently met with in all the affairs of life, and which yet never form the basis of an argument that because two things occur one after the other, therefore the one is the cause of the other. Of one thing there can be no doubt, and this is, that if the details of an outbreak—a series of little supposed facts—tell a story which is antagonistic to the general history, to the great facts regarding

[1] See paper on "The Sanitary lessons of Indian Epidemics" in *The Medical Times and Gazette* of July 21st, 1883.

cholera, then the little supposed facts must be wrong, or wanting in some most essential particular.

Steps in the evidence required to make out a case in favour of importation.

In order to make out a case in favour of the importation doctrine it is necessary to show—

(*a*) that there was cholera in the place from which the supposed importer arrived;

(*b*) that before his or her arrival there was no sign of cholera or of choleraic influence in the place into which he or she is supposed to have imported the disease; and

(*c*) that the cases among the residents which followed his or her arrival were connected with his or her attack, either directly or indirectly, in such a way, as regards the sequence of events and all other circumstances, as to warrant the conclusion that the connection between them was one of cause and effect.

Such conditions are absolutely necessary to make out a case in favour of importation, but it is astonishing how very few of the cases which are ordinarily cited fulfil these conditions. A few illustrations taken from Indian reports will make the points more clear.

Illustrations of cases of supposed importation in which this evidence is wanting.

In the history of the cholera among European troops in Bengal during 1880, the only instance in which the disease appears to be seriously attributed to importation is that adduced by the medical officer

in charge of H-6th Brigade, Royal Artillery, at Lucknow :—He writes—

"Towards the end of April a native servant returned to the station from Banda, where at that time cholera extensively prevailed. The day after his return he was attacked with cholera, and I directed him to be carried to the Staff Hospital for treatment. The people who carried him failed to find the Staff Hospital, and brought him to the hospital compound of the Royal Artillery division and put him down close to the surgery, where I found him when I came to pay the evening visit. I had him at once removed from the compound and carbolic acid thrown on the ground where he had vomited. It was in the ward a few feet off, after a slight fall of rain, that on July 4th (after an interval of more than two months) cholera appeared for the first time amongst the men of the Royal Artillery."

From these facts it is concluded that the native servant contracted the disease in Banda, and that, having been seized at Lucknow, he communicated the disease to others. But cholera had already commenced to be somewhat prevalent in the Lucknow district in the month of April, in the latter part of which the servant arrived. On the 18th of that month there was a case in the 13th Hussars in the cantonment of Lucknow, and the statistics of the district show that in the first four months of the year before this native servant arrived from Banda, there had been 143 deaths from cholera, or probably 300 cases. In Banda, during the same months, the number of deaths registered from cholera was only 3, *viz.*, 1 in March and 2 in April. During the early part of the year, in fact, cholera was much more prevalent in Lucknow than it was in Banda,

and therefore, so far as the evidence goes, the disease in the native servant in question was much more probably due to Lucknow than it was to Banda. But even if it had been proved that this native servant had contracted the disease at Banda and developed it at Lucknow, it still remains to be shown—and this is really the only point of any importance—that the disease in this man gave rise to disease in others. The mere coincidence that a patient in hospital, who lay not far from the spot where the evacuations of the servant had fallen on the ground, was attacked with cholera two months afterwards, is of no value, and can be accepted only as a coincidence to which no importance can be attached. Moreover, the facts, as given in the report above quoted, are at variance with the register, in which it is clearly shown that the first case among the Royal Artillery did not occur in the hospital but in barracks, where a man was seized four hours before the man in hospital.[1]

A second illustration may be taken from the Assam Sanitary Report for 1882. The Sanitary Commissioner states that the Civil Surgeon of Gauhati is inclined to attribute the outbreak in that place to importation from Barpetta where a severe epidemic of cholera was at its zenith of intensity. A man arrived on the 24th April from Barpetta, and located himself in the Pan Bazar. He sickened and died on the 30th April. On the 29th a man living near by was seized

[1] Seventeenth Annual Report of the Sanitary Commissioner with the Government of India, for 1880, page 114.

and died. It was not said when the man from Barpetta sickened, nor is it said whether the man living near by had had any communication with him. Moreover, no notice is taken of the fact that five deaths from cholera had been recorded in the town of Gauhati during the months of January, February, March, and April, before the Barpetta man arrived, and that during these same months 2,593 persons had died of cholera in the district. Taking the ordinary percentage of recoveries, it may be assumed that more than 5,000 cases of cholera had occurred in the district before the man from Barpetta arrived in the town of Gauhati. A narrative of a cholera outbreak which takes no account of such facts is of little value.

A third illustration may be taken from the Berar Sanitary Report for 1883. The following remarks are quoted from the district report by the Civil Surgeon of Amraoti : " Cholera prevailed with great virulence in the district from June until September. In April, there was a small local outbreak in Hamalpura, a small village near the city of Amraoti. This outbreak I traced, to my conviction, to contagion by importation. A woman came from Poona district, where cholera was prevalent, as I saw by accounts of its ravages in the public papers, and arrived at Amraoti by train. After her arrival she was attacked with cholera, and recovered from the disease. Immediately other cases presented themselves and sixteen deaths occurred." More exact particulars are supplied by the Sanitary Commissioner. It appears that this woman arrived at Amraoti on the 21st April. The first case among the residents occurred

on the 24th April, but no connection is traced between this case and the woman. Of sixteen people living in the house where the woman was attacked none suffered. Moreover, it would appear from the Report of the Sanitary Commissioner of Bombay that the first case of cholera in the Purundhur circle of the Poona district from which the woman came, did not occur till the 28th April, or seven days after the woman arrived at Amraoti.

A fourth and very remarkable example is afforded by recent proceedings of the Madras Board of Health. In their remarks for the week ending 22nd August 1884, the Board state that 45 deaths from cholera occurred during this week. The victims were mostly of the "poor classes who live in crowded and imperfectly-drained localities." The report goes on—"From the figures before the Board, it is of opinion that the sudden occurrence of cholera in so many localities of the city arose from its importation into Madras by people who returned on the 11th and 12th instant from Periapollium, 25 miles west of Madras, where a festival had been held on the 10th of August From the 13th instant the disease declared itself at Madras." No further details of the festival or the cases following are given, except the statement that "the early victims were those who had returned from the fair." But in the end of the report there is this important evidence: "Although the Board is of opinion that the cholera at Madras is traceable to importation from Periapollium, it must at the same time admit that there probably was some atmospheric condition antecedent to the importation of the disease favourable to its development, for the mortuary returns show that a death from cho-

lera occurred daily for three days in succession from the 6th to the 8th August, several days before the return of visitors from the Periapollium fair, which took place on the 10th August." That is to say, the disease was imported into this city several days after it had been there already! From the beginning of May, it may be added, 19 deaths from cholera had been recorded in it which, at the ordinary rate of mortality, would give about 38 cases.

Hundreds of examples of a like kind might be cited, but the above will suffice to illustrate what has been said on the subject.

Indian fairs are not the centres of cholera dissemination they are supposed to be.

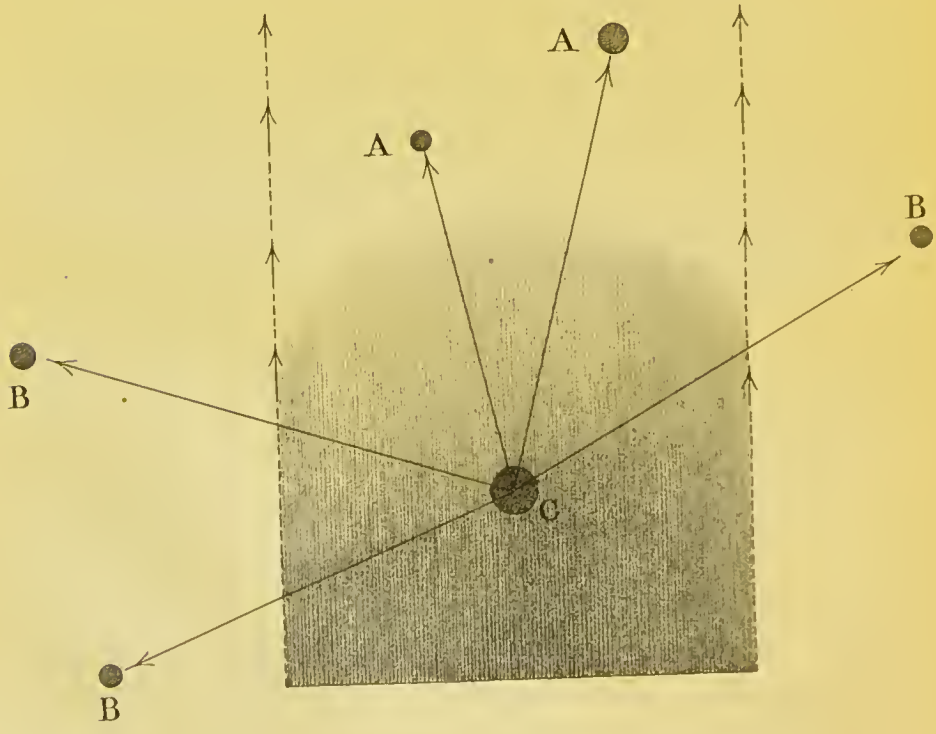
But it will be said, Is it not notorious that in India fairs are the great centres from which cholera spreads?—is it not an admitted fact that pilgrims going from such fairs are the great disseminators of the disease? This is no doubt the popular belief. In England and other countries, and even in India itself, where the facts ought to be better known, these great fairs are spoken of with horror, as if fairs and pilgrims were simply another name for the spread of cholera. The great fair at Hurdwar is associated in men's mind with a constant recurring epidemic spread by pilgrims year after year, and yet the fact is that during the last thirty years only two epidemics can in any way be connected even at first sight with Hurdwar. Only twice in thirty years — in 1867 and again in 1879 — have the pilgrims, either at or in going from Hurdwar, suffered from cholera beyond a few cases, and even these small outbreaks have been rare. When fairs take place at a time of cholera prevalence, the large collections of

people who frequent them, and who are crowded together and otherwise circumstanced so as to favour disease, often suffer, and as the crowds disperse they continue to suffer. It is not strange that people who are travel-worn and often ill-fed and crowded together at the various places where they halt should suffer, but the question is, Do they communicate cholera to others? At first sight it sometimes looks as if this were the case, but a more careful examination of the evidence shows that it is not so.

The seeming connection between human intercourse and cholera is often due to the slow movement of the main body of an epidemic.

The facts regarding Indian fairs have indeed been much exaggerated and misunderstood. In no instance has cholera ever radiated round all sides of a dispersing fair. The pilgrims themselves may have suffered much on all sides for a short distance till the influence of the fair itself had ceased to act, but there is no example of an epidemic among the people which has radiated all round a fair. The pilgrims have dispersed on all sides, but the people generally have suffered only in the direction in which the epidemic was travelling, and this also is the direction in which the returning pilgrims suffered far the most, and continued to suffer long after they had left the fair, because they *were moving in the same direction as the epidemic.* This movement of the epidemic is a fact which must not be lost sight of, and which must be carefully distinguished from the movement of the pilgrims or other travellers. As has been already pointed out, and illustrated by the experience of Europe, the main body of an epidemic, almost invariably, travels much more slowly than man travels.

This main body is, as a rule, the part that first attracts serious attention. The earlier isolated cases, which to the epidemiologist are often so important and full of significance, mean nothing to the ordinary local observer. They are only *sporadic*. They are of no consequence. They are merely the result of some indiscretion in eating or drinking. These isolated cases are rarely attributed to pilgrims or travellers. It is only when the main body of the epidemic has arrived that such an explanation is attempted. If it be admitted that the main body really travels at a much slower pace than man travels, a very common fallacy is easily accounted for. A diagram may illustrate the matter more clearly than any description—



The shaded lines show the direction of the advancing epidemic which is about to involve the places marked A, but not the places marked B. A traveller from C, which may be an ordinary town or village, or may be a fair, proceeds to B, and is attacked with cholera after his arrival, but no other cases will follow at B so long as it is outside the epidemic area. If, on the other hand, a traveller proceeds from C to A he may be attacked, and other cases will follow, which appear to be due to his arrival, but which are really due to the epidemic which has arrived very soon after him. The entrance of a person suffering from cholera or attacked with cholera soon after arrival from an affected area is a very different thing from the arrival of the epidemic itself, and this all experience very clearly shows.

The experience of ships is strongly against the contagion doctrine.

Some facts regarding the case of ships sailing from Indian ports have already been referred to. It has been shown that these ships through a long series of years have been singularly free from cholera, and that when cholera has appeared on board them, it has in all but very rare cases been confined to a few attacks. What is true of ships sailing from India at all times is true of ships sailing from other countries affected by cholera; as a rule, only a few isolated cases occur, but now and again a severe outbreak takes place, and is cited as a remarkable instance of the contagious nature of cholera. Even in these severe outbreaks there is generally some striking incident which shows that contagion will not explain the facts. The disease has been mostly, if not entirely, confined to persons who have come from a particular place, or, as

in the case of the *Crocodile* already referred to, the crew or some other well-defined portion of the community has altogether escaped, although all their supplies, including water, have been drawn from one common source. The question of "cholera in ships" has been discussed by Professor Pettenkofer, and the fallacy of attributing the striking results on them to contagion has been fully exposed. But how are the facts to be explained? In those instances in which the disease is limited to a few cases occurring soon after leaving a place where cholera was present, the disease is naturally to be attributed to that place; where the cases occur some time after departure, and still more when they are numerous, it seems most probable that the ship has passed through an area where the cholera-producing cause was at work. Such areas beyond all question do exist on land, and it is only natural and in accordance with the facts that they should exist also on the sea. It is remarkable that nearly all the severe outbreaks which have been recorded on boardship have taken place when there were unmistakeable signs of epidemic movement between different countries across the sea over which they were passing. And so far as the seeming relation between the movement of man and the movement of cholera is concerned, it is with ships exactly as it is with travellers on land. The ship comes through an epidemic area, it suffers from cholera, it travels faster than the epidemic, and so when it arrives at its destination, it seems to have been the carrier of the cholera. In reality it has brought only persons suffering from cholera. The cholera-produc-

ing cause follows more slowly after it. Just as troops moving away from an affected area so frequently escape further attack, so a ship which is on the move passes at once through the localities where the causes producing cholera are at work. It does not remain in them, and so, as a rule, it is little subject to them; but now and again, when the movement of the ship and the movement of the epidemic are synchronous, the ship suffers severely. This would seem to be the explanation, not only of the general immunity of ships and of the occurrence in rare examples of severe outbreaks on them, but it also accounts for the fact that when ships are in harbour they have no such immunity; on the contrary, they are very prone to attack in places where cholera is present at the time. This has been attributed to the men having been on shore, but it appears more probably due to the fact that the ship is *stationary*. If sent out to sea without delay, as has again and again happened in the Hooghly, cholera disappears.

Epidemic influence is a necessary factor even with the contagionists.

But it may be said, What is this imaginary cholera cause or influence which from the foregoing remarks would seem to be claimed as a thing existing beyond all doubt? What it is as yet we do not know, but of its existence there can be no question, because its effects are manifest. Even those who believe in the contagion doctrine are obliged to admit its presence and its power. Why is it that when a country is attacked with cholera, some places escape altogether, others suffer a little, and others suffer severely? Why is it that cholera shows itself in a place as only

a few isolated cases in one year and as a severe outbreak in another year? The ordinary reply is, it is the epidemic influence. The contagious matter has been carried here and there, but in some places the epidemic influence is wanting, and so the contagion causes little or no result; in another place this epidemic influence is present, and the result is that many suffer. The epidemic influence, in fact, even with those who believe in contagion, is the governing factor—the element which determines whether there is to be an outbreak or not. With those who do not believe in contagion also it is the governing factor, but with them it is more, it is the cause of the disease—in some places so strong as to produce a violent outbreak, in others so weak that it produces but a few isolated cases, or is only shadowed forth in the form of prevalent diarrhœa. The contagion is a superadded element which cannot be made to accord with the admitted facts of epidemic influence. What known poison is dependent for its power on locality or season or epidemic influence? And what proof is there that this imaginary cholera poison, or the discharges which are supposed to contain it, is more virulent at certain times or places than it is at others?

The doctrine of susceptibility will not explain the facts regarding cholera.

The doctrine of *susceptibility* is another hypothesis to which reference must be made. It is said that certain persons are attacked because they are *susceptible*—the *contagion* can affect them; and others it cannot affect—they are not "susceptible." But this doctrine of susceptibility, as has been often pointed

out, will not explain the facts regarding cholera. The disease often visits a place, disappears, and after a few months returns, to commit far more havoc than it did before. It is hardly possible that the persons who escaped in the first outbreak have become "susceptible" in the interval which elapsed before the second took place. It must be remembered that a person who has once suffered from cholera is by no means protected thereby from a further attack. There is no susceptibility or insusceptibility of this sort such as is observed in other epidemic diseases. There is nothing to show beforehand why one person should be seized and another escape. The result appears to depend chiefly on locality, though, as already stated, fatigue, exposure, grief, fear, or the use of saline purgatives, all seem greatly to favour attack. In most instances, however, all that can be said is, that so-and-so has been attacked and so-and-so has escaped, and the doctrine of susceptibility will no more explain the facts than it would explain why certain men in a battle are wounded or killed and certain men are untouched. In the case of both, much depends on the exact spot where each man happens to be.

The facts of improved water-supply in certain places lend no countenance to the doctrine of contagion; case of Calcutta.

The supporters of what is known under the name of the "water theory" claim to have demonstrated in certain cases that cholera is due to a specific contagium. Certain cases are adduced in which, coincident with decided improvement in the water-supply, there has also been a decided diminution

in the mortality from cholera. As examples of such cases may be taken Calcutta, Fort William, the city of Nagpur in the Central Provinces, and vessels carrying emigrants to Assam. In Calcutta the introduction of good water was immediately followed by a marked decrease in cholera, and this decrease, although it has not fulfilled the promise with which it commenced, yet has certainly distinguished the period since the new water was laid on as compared with the period before its introduction. It would indeed have been most disappointing if so great a sanitary blessing as the provision of good water to the inhabitants of a large city had not been attended with a decided improvement in the health of the inhabitants, and a decided reduction in one of the chief diseases from which they suffer. But that this reduction has not been due to the exclusion of any specific germ or poison from the drinking-water is proved by incontestible evidence. The cholera mortality, although happily reduced, has observed the same relative prevalence,

The City of Calcutta.

	1881.	1882.	1883.
January	63	129	204
February	72	111	129
March	227	170	227
April	370	318	490
May	138	380	393
June	36	254	130
July	49	54	38
August	59	52	38
September	80	38	38
October	100	91	162
November	232	232	103
December	267	411	85
TOTAL	1,693	2,240	2,037
Ratio per 1,000	3·9	5·1	4·7

The Suburbs of Calcutta.

	1881.	1882.	1883.
January	95	145	300
February	122	150	229
March	341	223	366
April	343	231	303
May	85	331	246
June	36	187	139
July	35	51	46
August	70	46	21
September	79	74	52
October	103	172	139
November	234	210	195
December	336	529	141
TOTAL	1,879	2,349	2,177
Ratio per 1,000	7·4	9·3	8·6

according to season as it did before,—the yearly rise in the spring, the decline in the rains, and the increase again in the end of the year. Moreover, it has fluctuated enormously from year to year, reaching in some years to very nearly as high a figure as what it was before the new water was introduced. In 1882 it equalled 2,240, and in 1883, 2,037. In 1868, before the new water was introduced, it was 2,270. The concurrent history of the suburbs of Calcutta is even more telling as evidence that the diminution of cholera in Calcutta has not been due to the exclusion of a specific germ from the drinking-water. The suburbs have as yet no proper water-supply, and they suffer in much larger proportion than the city itself, but the rise and fall of the disease in the two is synchronous. When cholera is at its height in the one, it is at its height in the other; when it is at its lowest in the one, it is at its lowest in the other. The facts show that, though Calcutta has benefited largely from the improvement in its

local conditions, it is still subject, though in a minor degree, to the same general influence as the suburbs, where no such improvement has been effected. These points are all illustrated by the figures given in the margin above.

Case of Fort William.

Much has been made of the case of Fort William, where it is alleged that the decisive diminution of cholera was exactly synchronous with the introduction of the Calcutta water, but the facts do not bear out this conclusion, except to an extent such as might be expected to result from any great sanitary improvement. The troops in Fort William were supplied with water from the municipal stand-pipes by means of carts from 9th July 1872, but the water was not laid on to the Fort till 25th March 1873. Before 1872 other great sanitary improvements had been effected, overcrowding had been prevented, and conservancy had received great attention. With these improvements, cholera was largely reduced from what it had been previously. In 1869, and again in 1871, not a single death occurred from cholera among the garrison, and yet in 1871 the water-supply was in a most unsatisfactory state and subject to great pollution. And now-a-days, in spite of this new water-supply, cholera still appears, and the few cases observe their seasons and their years of greater and less prevalence as they did before, although, as a striking illustration of the benefit of sanitary improvements—a benefit conspicuous before the Calcutta water came into use—the cases are now very few.

The case of the city of Nagpur.

The case of Nagpur in the Central Provinces is deserving of attention. In July 1872 this city was provided with a good water, and over a series of years the reduction in cholera mortality was most marked. In 1883, however, cholera was again prevalent, and the death-rate from this cause rose to 2·49 per 1,000, or eight times higher than it had been for 13 years. This outbreak had not occurred when Nagpur was cited as a striking illustration of the theory of contagion by means of water. The great increase in cholera mortality without any change in the water-supply is sufficient answer to those who seem to think that once provided with a good water-supply, a town has nothing more to do, and is absolutely safe from cholera. But one argument as regards Nagpur was founded not only on its relative immunity from cholera, but also on its relative immunity as compared with the district generally during a long series of years. The fallacy of such comparison is apparent to any one accustomed to deal with the history of cholera. As has been already explained, it is a disease of which perhaps the most remarkable characteristic in an epidemiologic point of view is its localisation. It attacks certain centres of population and leaves others untouched. To compare one of these centres of population, be it a town centre or a rural centre, with another centre of population over a series of years, and in this way to test their relative sanitary condition, is fair enough ; but to compare one of them—Nagpur in

this instance—with the annual average of all the others put together, is not fair, and can lead to no sound conclusion. Certainly, if Nagpur with a good water-supply is not better protected from cholera than it used to be before, there can be no truth in sanitation at all. The question is not, has the new water-supply diminished cholera in the city of Nagpur—of this there can be little doubt,—but has the diminution been so decided and so persistent as to show that the one sanitary improvement of a good water-supply can banish cholera? The answer undoubtedly is, No.

The case of immigrants going to Assam.

It has been urged that the experience gained in conveying immigrants by steamers up the River Brahmapootra has been so remarkable as to leave no doubt whatever that a well-protected water-supply does act by keeping out the specific germ of cholera. The mortality among these immigrants during each of the last seven years is contrasted in the Resolution of the Chief Commissioner of Assam on the Sanitary Report of that Province for 1883, and the results are shown in the margin. It was in 1877 that attention was first drawn to the use of filthy water for the purpose of washing and drinking on the steamers, and arrangements were made for the supply of a pure filtered water. From that time the mortality decreased, and in 1880 and 1881 it was

Year.	Number of deaths on the river.	Ratio per mille.
1877	604	23·9
1878	794	33·8
1879	106	8·2
1880	23	2·2
1881	18	1·6
1882	106	6·5
1883	138	6·6

not a twentieth part of what it was in 1877 and 1878. These statistics are no doubt very striking, but when the marked diminution in cholera mortality on board the Assam steamers was first claimed as a direct proof of the truth of the water theory, it was pointed out that one most important part of the evidence had been entirely left out of account. The concurrent history of cholera among the people of the country through which the steamers had passed was completely ignored. The diminution of cholera among the immigrants was credited to the change in the water-supply, but although there had been no change whatever in the water-supply of the general population on either side of the river along which the immigrants travelled, the diminution of cholera among them had been just as marked as it had been among the immigrants. Since then the results have not been quite so satisfactory. The mortality has considerably increased, and there have been several severe outbreaks of cholera on board Brahmapootra steamers. For example, in 1882, on the *Nepal* there were forty deaths from cholera among the immigrants. The comparison, moreover, between different years is no comparison at all, because the fact has been lost sight of that the length of the voyage in the case of the great bulk of the immigrants has been reduced from sixteen days to an average of about eleven days. In 1877-78, when the period of comparison commenced, about 70 per cent. of them embarked at Goalundo, but gradually this route was to a great extent abandoned, and the immigrants joined

the steamers at Dhubri, a place further up the river. So great has the change in this respect been that in 1883, the year in which the comparison ends, less than 20 per cent. embarked at Goalundo. The statistics, therefore, are altogether misleading, and the important fact, moreover, is left out of account that by escaping the five days' river journey between Goalundo and Dhubri the immigrants also escape a five days' journey through the endemic cholera country. Still, making due allowance for all this, the results are most gratifying, and they are all the more gratifying because the mortality from other diseases has been reduced in even a more marked degree than the mortality from cholera. The experience of the Assam immigrants thus, so far from teaching that cholera is to be banished by preventing a specific germ from entering the drinking-water, adds another to the many lessons to show that not only cholera but all other diseases are to be most successfully met by sanitary improvements. Further details regarding the Assam immigrants will be found in Appendix B. The figures for the earlier years cannot be obtained. All that is known about them is, that of 2,613 immigrants embarked at Dhubri during 1875-76, 28 died and that of 3,593 embarked at the same place in 1876-77, 32 died. The deaths from cholera are not distinguished from those due to other causes.

The water theory is negatived by the whole history of cholera in India.

The water theory is negatived not only by the experience of individual places as above cited, but by the general history of cholera in India year

after year. Is a year of great epidemic prevalence to be explained by the fact that in that year the water-supply over large areas has been polluted with cholera discharges, while in another year, when cholera is at a minimum, such pollution has been comparatively unknown? Is it to be supposed that when an epidemic is distinguished by unusual intensity, this intensity is due to the extreme virulence of the discharges, and that when an epidemic is distinguished by its comparative weakness, this weakness is due to the discharges being less potent than ordinary? Instances innumerable can be cited in which a community using numerous independent sources of water-supply have suffered at the same time and ceased to suffer at the same time, and others can be cited in which out of a community one well defined portion has entirely escaped, although the whole community were using the same water-supply. An instance of this has already been given in the case of H. M. S. *Crocodile*, and the same has occurred in many other ships and in many outbreaks among troops and prisoners where the facts were most carefully ascertained. The real lesson to be learned from the experience of places provided with a good water-supply is that this supply is a grand sanitary improvement calculated to improve the public health, but that it is only *one* of many requisites for health, and that the people who have provided a good water-supply for themselves have no reason to fold their hands and imagine that they are now quite safe from cholera.

Instances in which attendants on cholera patients have suffered more than others are generally to be explained in another way than by contagion.

The general freedom of attendants from attack has already been mentioned as one of the great facts which have been observed regarding cholera. Every now and again instances do arise which at first seem to favor the idea that the attendants have suffered because they had come in contact with a *contagium* emanating from the sick, but a careful consideration of all the facts generally leads to a very easy explanation. In some cases where attendants have suffered much, it will be found that they yet have suffered no more than others. The outbreak has been severe throughout the whole community. A striking illustration of this occurred in the Goorkha Regiment at Dhurmsala in 1875. Eleven attendants were attacked, and this was adduced as undoubted evidence of contagion, but an examination of the figures showed that the proportion of attendants attacked was only about one-half per cent. higher than among non-attendants. In this case, and also in others which have attracted attention, the hasty conclusion that the attack of attendants was due to contagion has led to mischief. The separate buildings which the attendants occupied, so as to be conveniently near the hospital, have not been vacated as they ought to have been, and as any other building would have been on the occurrence of a case among those residing in it, and in this way there is reason to believe that the attacks among attendants were more frequent than they otherwise would have

been. When attendants are attacked, it will be found that the largest number has been attacked just about the same time as the largest number occurred among the rest of the community. The attacks are thus to be attributed, not to attendance, but to the general epidemic influence at work. Moreover, the proportion of attendants attacked is frequently made to appear larger than it really was because the number of attendants has been incorrectly given. And further, it is not to be ignored that fear, which is so favourable to attack, is a factor which grows more and more powerful as a natural result of the contagion doctrines so generally inculcated in these days.

Illustration given.

The difficulty of obtaining accurate information on such a simple matter as the number of attendants on the sick and the number of these that were attacked is well illustrated by the following extract from the Fourteenth Annual Report of the Sanitary Commissioner with the Government of India :—

"In the report on the outbreak in the Alipore Jail, it is stated that of sixteen attendants four had been attacked, and this number has accordingly been entered in the tabular statement given in the Appendix. But the record is altogether fallacious, and represents a proneness on the part of attendants to be attacked, which is unwarranted by the actual facts. Correspondence having failed to elicit an accurate account of what actually happened, a personal enquiry was made, and the following points were then established :—

(*a*) The attendants on the case in January, which forms

one of the eighty on the register, are not included in the statement; none of them were attacked.

(*b*) The cholera hospital was opened on the 12th June, when the second and third attacks took place; but it was usual throughout the outbreak to bring every case to the ordinary hospital, unless it was undoubtedly a case of cholera. In this way many cases which afterwards proved to be cases of undoubted cholera were treated in the ordinary hospital for hours, and some of them for a day or two, until the symptoms became pronounced, and they were then transferred to the cholera hospital. The attendants on such cases were not included among the cholera attendants.

(*c*) Several cases—the exact number is not known—in which the symptoms were very severe, and which might well have been returned as cases of *cholera*, were entered as only cases of *diarrhœa*, and were treated throughout in the ordinary hospital. The attendants on these are not included in the statement.

(*d*) In several instances friends among the prisoners were allowed to wait on those ill of cholera. The number of these is not known; none of them appear in the statement of attendants.

(*e*) The attendants entered were taken from the convalescent gang. There were at that time forty in the convalescent gang. If the number of attendants given is correct, their attendance on so many cases of cholera must have been a very serious matter. It must, for weeks together, both by day and night, have involved the most harassing labour and want of rest, and it would not be in the least

surprising if persons so exposed to fatigue and want of sleep had suffered more than others.

The facts elicited on the enquiry have been given in detail, because it is very important that such errors should be avoided, and that the information contained in each report should be thoroughly accurate, and not, as it was in this instance, incorrect and misleading."

The argument that because cholera never moves faster than man, therefore man must be the carrier of cholera, is fallacious;

It has already been shown that no relation can be established between the rate at which the main body of a cholera epidemic travels and the rate at which the ordinary traffic of the country moves. The want of easy communication does not retard it, and the much more rapid means of travelling in modern times do not accelerate it. The main body of a cholera epidemic, as has already been shown, never travels so fast as man; but because it never travels faster than man, the fact has been claimed as evidence that human traffic must be the means by which it is spread. In nearly all cases before the main body advances there have been unmistakeable signs of the epidemic here and there over vast areas. These the supporters of the human intercourse doctrine have never attempted to explain, but leaving them out of account, it cannot be inferred that because cholera never travels faster than man, therefore man must be the carrier of cholera. On this argument, as was remarked in the report on the cholera of 1879,[1] much stress has been laid, but it is altogether

[1] Report of the Sanitary Commissioner with the Government of India for 1879.

fallacious. Even if it were proved that the cause of cholera is carried, and that it is never distributed faster than man can travel, it does not follow that it must be carried by man. Precisely the same argument might be applied to the monsoon. The monsoon generally takes many days to travel across India: it takes much longer than the time in which a man can now accomplish the same distance with ease; but no one argues that because the monsoon never travels faster than man, therefore man must be the carrier of the monsoon, or of the marked changes in the atmospheric conditions which the monsoon brings with it. The illustration is selected with no view to claim connection between cholera and the monsoon, but only to show that the mere fact that cholera never travels faster than man, even if this were established, does not prove that cholera must be carried by man, for other great phenomena, on which it is self-evident that human agency can have no influence whatever, are often distributed no faster than man can travel.

as well as the argument based on the fact that seaport towns are so often the first attacked.

Again, it is often argued that cholera must be carried by man because it so often appears first in the seaport towns of the countries which it invades. This experience is by no means invariable. The epidemic occasionally shows itself right in the heart of a country, but even if it did invariably attack seaport towns first this would prove nothing. Here again the south-west monsoon affords a very apt illustration. This monsoon always breaks on the

coast. Year after year its bursting at Bombay is heralded as the first unmistakeable evidence of its arrival on the shores of Western India. But no one would argue that because it shows itself first at Bombay it must have come by ship. It is only what is to be expected that a great atmospheric change sweeping across the ocean should first make itself felt on the shores of the country which it has reached; and if cholera be really but the result of another great atmospheric change which, so far as is yet known, manifests its presence by inducing in human beings those symptoms which are known as cholera, is it strange that it should first appear in centres of population on the coast—in the seaboard towns where human beings are congregated?

Other atmospheric phenomena are often localised in a remarkable manner.

The suggestion that cholera may be due to an atmospheric change is frequently met with the retort that if cholera were due to the atmosphere no one would escape, and this argument is usually accepted as conclusive. But it is by no means conclusive. Other atmospheric phenomena which can be seen and felt in a manner about which there can be no mistake are often localised in quite as remarkable a way as the cholera-producing cause seems to be. Even over a limited area the rain does not fall equally in all parts. In some it is much heavier than it is in others. The storm of wind or hail often has a very definite track over which it may be most destructive, and yet the places on either side of this track are left unscathed.

And even within this track all parts do not suffer alike. The uprooted trees, the ruined buildings, and many other signs, all testify to the fact that even within the general area it has covered, its violence has fallen chiefly on particular spots. So far as can be judged by the results, the same would seem to be the case with the atmospheric conditions which are known by their results in the form of cholera.

Atmospheric conditions have a most important bearing on disease.

In these days, when the tendency is to ascribe so much to germs or specific poisons, the conclusion that disease, and especially epidemic disease, may be due to a condition of atmosphere will not be readily accepted. The mere existence of the disease is urged as sufficient evidence of the existence of an entity producing it. The result, it is argued, must be due to *something*. True, it must be due to something; diseases, like everything else, are due to a cause which produces them, but it by no means follows that this cause is an entity. Disease may be due, as many other things are due, to a mere force. The greatest powers in the world are not entities at all,—such, for example, as light and electricity, heat and cold. No one doubts their power, and yet in not one of them are the tremendous results to be ascribed to the existence of any entity, to anything which can be seen by the naked eye or demonstrated under the most powerful microscope. It will be admitted that electricity kills and leaves no trace of any germ behind it, but it will be said that, so far as is known, electricity or the want

of electricity in the atmosphere does not produce disease. So far as is yet certainly known, this is true, but are there not other conditions of atmosphere which do produce disease? Have heat and cold nothing to do with disease? The atmospheric and other conditions under which people live are of far more importance to health than is generally supposed in these days. To the contagionist the air a man breathes, the food he eats, the water he drinks, the clothes he wears,—in fact, the whole circumstances of his life,—are of not the smallest importance in respect of cholera, so long as he does not swallow or take into his system in some way or other the specific germ of that disease. But this narrow view is negatived by all experience.

It is very necessary to have a full statement of all the facts on which conclusions are based;

The accusations made against India in respect of cholera have been many. Not only has it been accused of being the one part of the world which manufactures cholera and exports it to the destruction of the human race in all other countries, but the Government has been accused of suppressing facts which go to prove that this commonly accepted view is correct. For example, in the House of Commons on the 15th July last, the Under-Secretary of State for India was asked whether the Government of India had not reprimanded the Sanitary Commissioner of Madras, because in his Report for 1881 he had stated facts which seem to prove that an epidemic of cholera in Southern India had been due to the importation of the disease from Tirupati and its

dissemination by infected pilgrims. What the Government of India did complain of in this instance was that the Sanitary Commissioner had enunciated a theory without taking the trouble to examine the facts and that if he had examined the facts, he would have found that they were diametrically opposed to the theory. He would have seen that in the district where this Tirupati fair was held, out of 5,241 villages only 69 returned deaths from cholera, that the districts which suffered most were those far removed from the fair; that the intermediate country hardly suffered at all; and that, in fact, there was no evidence of any connection between the fair and the distribution of the cholera. Unless a careful supervision is exercised, there is a constant tendency to substitute mere theories for facts, even when, as in this instance, they are at direct variance with the facts on which they are supposed to be based. Other errors also occur. For example, the Sanitary Commissioner of Madras, in the report above referred to, considered that the ratio of male births should be calculated on the male population, and the ratio of female births on the female population, and failed to see the absurdity of such a method even when it had been pointed out to him!

Again, it has been asserted that medical officers in India have been discouraged and indeed prohibited from reporting facts which favour the contagion theory of cholera. A more groundless assertion was never made. The printed form of report is in itself

and to collect the complete data of every outbreak in all its aspects.

a complete answer to it. This printed form for convenience sake asks a series of definite questions to which answers are desired. They are divided into six sections. Regarding the first five, A to E, it is noted that "they should be strictly confined to a statement of facts, and should contain no opinions," but in section F medical officers are invited to give any "information or opinions not included in the above." The freest scope is thus afforded for anything and everything the reporter may wish to say. All that is desired is that the facts should be accurately stated, and that they should be kept in a separate section from the opinions which may have been based on them. Most medical officers prepare their cholera reports with much care in this and all other respects, but it occasionally happens that great difficulty is experienced in getting at the exact facts; and mere opinions are often substituted for facts. In reply, for example, to the question "Could the first case be traced to importation?" such vague answers as these are not unfrequently given: "The first may have contracted it in the bazar;" "It may have been imported;" "The first case probably imported itself;" "He may have caught the disease in the railway train;" &c., &c. If the facts are not known and cannot be ascertained, this should be clearly stated; if they are known they should be detailed. A bare assertion of probabilities is not evidence at all.

And while endeavour has thus been made to col-

For many years a special miscroscopic enquiry into cholera was carried on in India.

lect all the ordinary data regarding cholera in India, scientific enquiry has been neither undervalued nor neglected. The Government of India was in fact the first to undertake a special microscopic enquiry into cholera. In the beginning of 1869, two medical officers, T. R. Lewis of the Army Medical Department, and D. D. Cunningham of the Indian Medical Department, were selected for this purpose. For upwards of ten years they were devoted entirely to it, and the results of their investigations, which were published from time to time, are well known and have been highly appreciated. It is true that so far as the discovery of any specific cholera germ is concerned, these results were altogether negative. They failed to discover anything of the kind; the conclusion to which all their researches pointed was that no such germ existed, and that it certainly is not to be found in the discharges or in any of the tissues of persons suffering from cholera.

Koch's bacillus—the German Cholera Commission in Egypt.

But it will no doubt be replied by many that Professor Koch has discovered what Drs. Lewis and Cunningham failed to discover—he has found the microscopic cholera germ in the discharges and intestines of cholera patients, the "microbe" or "bacillus" of cholera; he has proved beyond all doubt that this is the specific cause or germ of the disease, and has solved the whole cholera mystery. Such assertions have

been common during the last few months, not only in the ordinary newspapers of all countries, but also in the medical journals. But are these assertions correct? The facts briefly stated are as follows. Towards the end of 1883, when cholera was still in Egypt, a Special Commission was sent there by the German Government to investigate into the disease. This Commission consisted of Messrs. Koch, Gaffkey, and Fischer. Dr. Koch was the head of this scientific mission, and all the official information regarding it is contained in the provisional reports of their work which he has sent in from time to time. The full report has not yet been completed, or if it has, no copy has yet reached India. In his first report from Egypt Dr. Koch writes :—

"Neither in the blood nor in the organs which in other infectious diseases are usually the seat of micro-parasites—*viz.*, the lungs, spleen, kidneys, liver—could any organised infectional matter be detected. Occasionally bacteria were found in the lungs, which, however, as appeared from their form and from their situation, had nothing to do with the real process of the disease, but had been inhaled into the lungs with matter vomited from the stomach."[1]

The vomit was comparatively free from micro-organisms, but the evacuations were found to contain considerable quantities of them, and a particular kind of bacterium was found in the coats of the intestines. Regarding these bacteria Dr. Koch thus continues :—

"They resemble most nearly in size and form the bacilli

[1] Report dated Alexandria, 17th September 1883.

found in glanders. In cases where the intestine shows the very slightest changes microscopically, the bacilli had penetrated into the follicular glands of the intestinal mucous membrane, and had there occasioned considerable irritation, as evidenced by the widening of the lumen of the gland, and agglomeration of multinuclear round cells in the interior of the gland. In many instances the bacilli had also burrowed beneath the epithelium of the gland, and multiplied between the epithelium and the glandular membrane. Moreover, the bacilli had copiously settled on the surface and in many cases penetrated into the tissue of the intestinal villi. In the more severe cases, where blood had filtered into the intestinal mucous membrane, the bacilli were found in great numbers, and had not limited their invasion to the follicular glands, but had travelled into the surrounding tissue, the deeper layers of the mucous membrane, and in parts even as far as the muscular coat of the intestine. The intestinal villi also were in such cases copiously occupied by bacilli. The chief seat of this devastation is in the lower portion of the small intestine. If this discovery had not been obtained from quite fresh corpses, it would have been of little or no value, because the influence of decomposition is sufficient to bring about such growths of bacteria in the intestine."

Numerous experiments were made with animals with the object of inducing cholera in them either by feeding them with cholera evacuations or by inoculating them with these bacilli, but they all failed. Among other reasons for the failure it was supposed that, perhaps, as the epidemic was dying out in Egypt, the virulence of the morbid matter was expended. It was therefore resolved that the Commission should go on to India.

They accordingly proceeded to Calcutta, arrived there on the 11th December 1883, and continued their investigations in that city till the beginning of March. The result of these investigations went to confirm all that had been observed in Egypt. The same bacilli were found in the discharges of cholera patients, very rarely in the vomited matters, but abundantly and constantly in the other evacuations. They were also found in the intestines of those who had died of cholera. These bacilli were carefully isolated and propagated. Their characteristic peculiarities in shape and growth were ascertained, and they were clearly differentiated from other bacilli. They were not found in the blood or tissues of cholera patients, nor were they found in the numerous examinations which were made of the bodies of persons who had died of diseases other than cholera. These bacilli are described as not quite rectilinear like other bacilli, but slightly curved like a comma, and their behaviour in the intestines is described as follows [1]:—

Their work in India.

"In the first evacuations of the patients, as long as they are of genuinely fæculent character but few cholera bacilli are found; the succeeding watery, inodorous dejections, on the other hand, contain the bacilli in abundance, while, at the same time, all other bacteria almost entirely disappear, so that the cholera bacilli at this stage of the malady are almost isolated from all other bacteria. As soon, however, as the cholera abates, and the evacuations resume the fæculent char-

[1] Dr. Koch's report dated 2nd February 1884.

acter, the comma-shaped bacteria gradually disappear again, and upon the complete recovery of the patient are no more to be found. The results of examination of the cholera corpses is similar. No cholera bacilli are found in the stomach. The state of the gut varies according as death supervened during the actual attack of cholera or after it. In the freshest cases, in which the intestine presented a uniform bright red tint the mucous membrane is as yet free from infiltration of blood, and the contents of the intestine consist of a whitish inodorous fluid, the cholera bacilli are found in the intestine in enormous masses, and almost without admixture of other kinds of parasites. Their distribution corresponds very closely to the degree and extent of inflammatory irritation of the intestinal mucous membrane, being generally less numerous in the upper part of the small intestine, and more abundant near its inferior extremity. But when death has occurred at a later stage, the signs of a serious reaction are found in the intestine. The mucous membrane is of a dark-red hue in the inferior part of the small intestine, permeated with extravasated blood and often mortified in the superficial coats. The content of the intestine is in this case more or less tinged with blood, and, in consequence of the now renewed copious development of decomposition bacteria, of putrid character and fœtid. At this stage the cholera bacteria become less and less prominent, but are still for a while pretty copiously present in the follicular glands—a circumstance which at first directed attention to the presence of these peculiar bacteria in the intestine in Egyptian cholera cases. They are wanting entirely only in cases where, after recovery from cholera, death has been due to a succeeding malady."

The following remarks regarding these bacilli are also of great importance :—

"It has been further ascertained that their growth proceeds

normally in nutrient substances with alkaline reaction. Even a very small quantity of free acid which has no perceptible influence upon the growth of other bacteria strikingly retards their development. In a normally acting stomach they are destroyed, as appears from the circumstance that repeatedly in animals to which cholera bacilli had been constantly administered, and which had afterwards been killed, the bacilli could not be traced either in the stomach or the intestinal canal. This last-named peculiarity, together with the slight power to resist the effects of desiccation, serves to explain what is daily observed, viz., how seldom cholera is contracted by immediate intercourse with cholera patients and their products. Hence the concurrence of other circumstances is clearly necessary in order that the bacilli may be put into a condition to pass the stomach, and then to provoke the cholera process in the intestine. Perhaps the bacilli may pass uninjured into the stomach if digestion is disordered—a supposition favoured by the observation made in all cholera epidemics, and also regularly here in India, that such persons very frequently contract cholera who have been suffering from indigestion. Perhaps also a particular condition in which these bacteria are placed, and which may be analogous to the permanent condition of other bacteria, may enable them to pass the stomach uninjured." [1]

Their account of an outbreak of cholera believed to have been caused by bacilli in the drinking-water.

The proceedings of the Commission, so far as they have yet been referred to, concern only the microscopic and other physical characteristics of these bacilli, but in his report dated 4th March 1884 Dr. Koch narrates certain occurrences in connection with an outbreak of cholera in a suburb

[1] Report dated 2nd February 1884.

of Calcutta and the discovery of the bacilli in the water of the neighbouring tank from which the inhabitants draw their supply. The circumstances are thus described:—

"For a few days unusually numerous cholera cases were reported from Saheb Bagan, at Baliaghatta, one of the suburbs of Calcutta. The attacks were limited exclusively to the huts inhabited by several hundred persons situate round a tank, and out of this population seventeen persons died from cholera, while at some distance from the tank, and throughout the same police district, cholera did not prevail. It is worthy of note that the same spot has been in recent years repeatedly visited by the cholera. Upon the origin and course of the epidemic careful investigations were now instituted by the Commission, wherefrom it appeared that the tank was used in the usual way by the neighbouring dwellers for bathing, washing, and drinking, and also that the soiled linen of the first fatal cholera case was cleansed in the tank. A number of samples of the water were then taken from different parts of the tank, investigated by means of culture in nutrient gelatine, and cholera bacilli found in considerable abundance in several of the first specimens. Of the later samples which were procured towards the end of the epidemic, only one, which came from a particularly foul part of the tank, contained cholera bacilli, and these only in very small number. When it is remembered that hitherto cholera bacilli have been vainly sought for in numerous samples of tank water, sewage, river water, and other water exposed to all sorts of impurities, and that these bacilli, with all their characteristic peculiarities, have been found for the first time in a tank around which cholera epidemic was raging, this result must be regarded as a most important one. It is evident that the water in the tank was infected by the cholera

linen, which, as earlier investigations showed, usually contains the cholera bacilli in special abundance; it is further proved that the dwellers by these tanks used this infected water for domestic purposes, and, indeed, for drinking. We have here, therefore, an experiment, due to chance, upon the human subject, which, in this case, compensates for the failure of infection experiments upon animals, and further corroborates the hypothesis that the specific cholera bacilli are in reality the cause of the disease."

Koch's conclusions examined.

Such is a general summary of the evidence on which Dr. Koch bases his contention that this bacillus is undoubtedly the cause of cholera. In India so far no exception has been taken to it in any official documents. It seemed better to wait till his complete report had been received, and the full authoritative evidence on which it rested could be examined, but further delay is not desirable, especially when cholera is now the subject of so much immediate interest in Europe, and continued silence on the part of the Indian Sanitary authorities might be misinterpreted to mean that they accepted the conclusions of the German Commission. These conclusions must now be examined in detail, and the questions naturally arise—Is this comma-shaped bacillus an object which has been for the first time described by Dr. Koch? Is it so distinctive of cholera that it ought to be called the "cholera bacillus?" And if so, is it the *cause* of cholera? The first question is of no practical importance. Even if the bodies described and figured by Koch had ever been described and figured

previously, Koch was undoubtedly the first to attach special significance to them as the cause of cholera, and the full credit for any discovery which has been made in this respect is his beyond all question. But are these comma-shaped bacilli distinctive of cholera? Are they always found in cases of cholera, and are they never found under any other circumstances? Are they never to be found in healthy persons, or in cases of diseases other than cholera? On this question the only evidence supplied so far has been supplied by Dr. Koch. There is not the smallest reason to doubt that it is strictly accurate so far as it goes, but it may be questioned whether the examinations of non-cholera cases—the control experiments as Koch calls them—have been sufficiently numerous to afford a complete answer to the second part of this question. If it should hereafter be shown that bacilli in all respects undistinguishable from the "cholera bacillus" are to be met with altogether unconnected with cholera,—if even *one* single instance of this kind can be established,—the whole evidence on which belief in the "cholera bacillus" now rests will necessarily collapse.

Reasons why his conclusions cannot be accepted either on the microscopic and experimental results;

But even if the facts should eventually prove to be exactly as Koch has stated them, what value is to be attached to them? Are they sufficient to demonstrate that this "cholera bacillus" is the cause of cholera? May it not be only the consequence of the disease? It is very rarely found in the vomited matter, where it would surely be

present if it were taken in by the stomach as Koch supposes. It is not found in the tissues after death. Practically it is confined to the intestines and to the evacuations from them, and on this account it would seem to be a *local* development favoured by the peculiar circumstances attendant on the disease. The mere fact that this bacillus and the symptoms known as cholera are invariable concomitants no more proves that the bacillus is the cause of the cholera than it proves that the cholera is the cause of the bacillus. Cholera discharges are quite distinctive of the disease. They are found in no other disease, nor can they be produced by any other agent—not even by arsenic, which produces the nearest approach to them. They are peculiar to cholera, but no one infers from this that they are the *cause* of cholera. If the evacuations are a distinctive result of cholera, it would not be strange if the presence in them of large numbers of a peculiar bacillus were also the result of the disease. It is to be noted that no evidence has been adduced to show that these bacilli can produce the smallest effect. All attempts to induce cholera in the lower animals by feeding them on the discharges or inoculating them with the bacilli entirely failed. Not a single one of the animals experimented on showed the smallest sign of cholera. Dr. Koch must have been greatly disappointed at this result. The Commission came to India with the express object of conducting such experiments and of so demonstrating that the bacillus is undoubtedly the cause of cholera, but all the endeavours in this direc-

tion led to no result whatever. On this point Dr. Koch, in his report of 2nd February 1884, remarks :—

"It would of course be desirable to succeed in artificially inducing upon animals, by the employment of these bacteria, a malady analogous to cholera, in order to afford ocular demonstration of their causal relation to the disease. This, however, has not succeeded, and it must accordingly be considered questionable whether it will ever succeed, since, according to all appearances, brutes are not susceptible of choleraic infection. Could any species of brute have contracted cholera, this must have occurred in Bengal, where choleraic infectional matter is spread throughout the whole year and the whole country : it must have been noticed occasionally in a reliable manner. But all enquiries on the subject have resulted negatively."

This view may be correct. It is true that cats in India have suffered from epidemic disease very much resembling cholera. There was a remarkable case of this kind at Delhi in 1875, when 500 cats are said to have died, and others at Ahmednagar in 1881 and at Sirur in 1883. But Koch's opinion may be correct, and it is certainly a fact that the lower animals, even in Bengal, where the disease is always present among the people, rarely if ever suffer from symptoms quite like those of cholera in man. But it is to be observed that, in his earlier reports, Dr. Koch expressed a very different opinion as to the absolute necessity of proving by experiment that the bacillus really stands to cholera in the relation of cause and effect. Writing on the 17th September 1883 from Egypt he says :—

"The coincidence of cholera with the presence of bacilli in the intestinal mucous membrane does not yet, however,

warrant the conclusion that the bacilli are the cause of the cholera. The relation between them may be the inverse, and the hypothesis might equally well be adopted that the process of cholera occasions such devastation in the intestinal mucous membrane as to enable some particular kind of bacilli from among the numerous parasitic bacteria constantly existing in the intestine to penetrate into the tissues of the intestinal mucous membrane. Which of these two hypotheses may prove to be the true explanation of the facts,—that is, whether the process of the infection or invasion of the bacteria constitutes the primary disturbance,—can only be decided by isolating the bacteria from the diseased tissues, propagating them artificially, and then regenerating the disease by means of infection experiments upon animals."

And in his work on the etiology of tuberculosis[1] he thus expresses himself:—

"It is necessary not only to establish the coincidence of the disease and the parasite, but also to prove directly that these parasites are the real cause of the disease. This can only be done when the parasites from a diseased organism are completely freed from all products of the disease to which any sickening influence could be ascribed, and when the disease with all its characteristic properties can be called forth anew by the introduction of the isolated parasites into a sound organism."

or on the story of the tank.

The evidence afforded by the story of the tank is very vague. No dates are given, and no other details. These may be forthcoming in the complete report, but, as the case now stands, the mere finding of bacilli in a tank where cholera soiled clothes have been washed is no more a proof that they were the cause of cholera than the

[1] "Contributions from the Imperial Health Office" of Germany, Vol. II, page 3.

finding of them in the intestines or evacuations of a cholera patient. On this point Professor Pettenkofer's comments in the *Allgemeine Zeitung* of July 24th are very pertinent.[1] He writes:—

"Virchow looks upon the relation of cholera to water quite in the sense of an adherent of the water theory, and regards the demonstration of Koch's cholera bacillus in a tank in Calcutta as a 'drastic' confirmation of his views. *In the interest of the adherents of the water theory, it would have been well had this case never been published, as it only shows a loss of critical faculty in favour of preconceived opinion.* Koch was led to make the investigation by the prevalence of cholera in the neighbourhood of the tank. But the inhabitants did not merely drink from this tank, they also bathed and washed their clothes in it. It was therefore to be expected that the cholera bacillus would inevitably be present in the water. It has not been shown that the bacillus was present in the water before the occurrence of cholera in the vicinity, but *it is only shown that it was present after choleraic clothes had been washed in the tank;* and finally it is shown that the bacillus disappeared when the cholera *disappeared,*—that is, *when there were no more choleraic clothes to be washed.*"

The story of the tank must therefore be set aside as no evidence at all, and what remains then in support of Koch's statement that the bacillus is the cause of cholera? Merely the coincidence of the presence of these bacilli in cases of cholera,—merely the circumstantial evidence which Dr. Koch himself,

So far there is no evidence in favour of the bacillus being the cause of cholera except that of coincidence—a kind of evidence which Koch has himself declared to be altogether inadequate.

[1] Translated in "India Medical Gazette" of September 1884, page 264.

only a few weeks before he came to India, declared to be altogether insufficient. In making these remarks, there is no desire to undervalue Koch's work. Every item of fact which can be added to our knowledge of cholera is of importance, and in this respect the discovery of bodies which, so far as is yet known, appear to be peculiar to cholera, is most valuable, but because such bodies have been discovered, it by no means follows that they are the *cause* of the disease, and that the whole mystery which has puzzled mankind so long has been solved.

Other statements made by Koch require correction.

Since his return to Europe, Dr. Koch has made other statements of a general character in regard to cholera in India, which show that he has been misinformed and which require correction, because they all go more or less towards supporting his cholera bacillus. They are chiefly to be found in his address before the Conference which lately assembled at Berlin, and in the course of the discussion which followed.[1] He says that "we have instances amounting to actual experimental infection of those who engaged in washing linen soiled by choleraic dejecta." Instances, no doubt, have occurred in which those who have washed such linen have been attacked, but if Dr. Koch means that persons who wash choleraic soiled linen are more subject to attack than others,—

[1] Translated in "Lancet" of August 16th, 1884, from the "Berlin Clinical weekly News."

and unless he means this the evidence has little point,—the statement is negatived by all Indian experience. Washermen are no more subject to cholera than other people, nor are sweepers who handle evacuations with the greatest freedom and without the smallest precautions. If the bacillus really produced cholera then there ought to be abundant evidence of this kind, but the evidence is all in the opposite direction. Again he says that the delta of the Ganges "is the only region where the disease never varies from year to year; for although some other regions, as Bombay, are never free from it, yet it is highly probable that this is due to its continued re-introduction;" that "the diffusion of cholera in India depends on human intercourse, especially on pilgrimages;" that "hundreds of thousands flock yearly to Hurdwar and Puri, remain there many weeks herded together, bathing in the tanks that supply them also with drinking-water;" that "every year the danger to Europe by the Suez Canal route increases;" and that "an attack of cholera confers immunity at least during the period of one epidemic, and whole districts may enjoy a similar immunity for a time, cholera having been in the place one year passes it by in the next." These are Dr. Koch's opinions, but it would be interesting to know on what facts they are based. Dr. Koch has been entirely misinformed. It has already been shown that in the Delta of the Ganges cholera varies enormously from year to year, and that in many parts of India it is so constantly present that there is no room for supposing that it is due to re-introduc-

tion,—that connection between pilgrimages and the diffusion of cholera in India is a popular error, especially as respects Hurdwar, where, it may be remarked, there are no tanks, and the people bathe in the Ganges. The statement that the Suez Canal involves an increasing danger to Europe in the light of the facts adduced in the second chapter can be regarded as an opinion which is based on theory but opposed to evidence; and as for one attack of cholera conferring immunity from subsequent attack, either on individuals or on whole districts, it would be difficult to advance a statement which is more at variance with experience. Professor Virchow speaks of the precautions which Dr. Koch recommends as an infallible protection against the *infection* of cholera,[1] and seems to infer that to these Dr. Koch and his assistants owed their preservation from attack during their short sojourn in Egypt and India. What these precautions were is not mentioned, but it may be remarked that Drs. Lewis and Cunningham worked with cholera material almost continuously for ten years without any precautions against infection, and they never suffered from the disease. If the present signs of a cholera epidemic in Europe are fulfilled, as unfortunately seems very probable either this year or next year, there will be ample opportunity of testing the practical value of these precautions. If they prove effectual, Dr. Koch will indeed have conferred a great boon on the human race. The theoretical part of the question will then be of very small moment.

[1] "British Medical Journal," July 5th, 1884.

His statement that putrefaction is favourable to the destruction of the cholera bacillus is calculated to do mischief.

But just at present, when practical evidence of this kind has not yet been obtained, Dr. Koch's remarks on the relation between the *comma bacillus* and other bacilli are deserving of attention, for they would seem rather to discourage the cleanliness and other reforms which are now commonly believed to be of value as preventives against cholera. Speaking of sulphate of iron as a disinfectant in the way ordinarily used, he says it does not kill comma bacillus, it only hinders its growth for a time, and he thus continues: "I believe it to be possible that by such agents a result contrary to the desired end is obtained. Given the case of a cesspool whose contents it is desired to disinfect, into which comma bacilli have found an entrance; according to my view, the putrefactive processes already going on in the cesspool are sufficient in themselves to kill the comma bacillus. If now, however, sulphate of iron be added in sufficient quantity to cause an acid reaction, and thereby the putrefactive processes be arrested, then we get no other result than a mere cessation of the growth of bacteria and the comma bacillus. The bacteria are by no means killed thereby, and as far as the comma bacilli are concerned, the injurious influence of the putrefactive processes is withdrawn and they are preserved instead of being killed." In another passage he says: "I may therefore almost assume that if comma bacilli are brought into a decomposing fluid which contains many of the products evolved by other bacteria, and especially by those of putrefaction, they cannot develop, but soon

die. Upon this point, however, sufficient experiments have not been made; it is a mere presumption which I may hold upon other experiences gained with cultivations of bacteria." Even when enunciated in this doubtful manner, such doctrines seem calculated to do much mischief.

The eagerness to accept the bacillus as a fact is most extraordinary.

But perhaps the most noteworthy of all the incidents connected with the "cholera bacillus" is the extraordinary eagerness with which the supposed discovery was believed in both by the medical profession and the public. No sooner was it telegraphed from Calcutta that Dr. Koch had found the real cause of cholera than the statement was at once accepted with hardly one word of dissent. It seemed never to have suggested itself that perhaps the conclusion was somewhat hasty, that the facts needed very careful investigation, and that before such an investigation had been satisfactorily made, it was altogether premature to form any conclusion on the subject. No—the announcement fitted in so completely with what was desired according to the theories of the day, that Koch was at once proclaimed as one of the greatest discoverers the world had produced, and this was all the more remarkable because in accepting Koch the believers in the doctrine of a specific germ discarded without the smallest hesitation the most valuable testimony they had previously had in favour of their views. For nearly thirty years they may be said to have subsisted on Burdon Sanderson's experiments with mice. This was the one piece of direct evidence advanced to show that cholera discharges are

really capable of causing the disease in others. These experiments were entirely negatived by Koch, just as they had been negatived years before by Ranke; but although the old ground was thus taken away, the doctrine which had been based in great measure upon that ground was regarded as more firmly established than ever.

Koch's bacillus has since been proved to be not peculiar to cholera.

In the above paragraphs Koch's statements as to matters of fact have been accepted as if they had been proved beyond all manner of doubt; but since these paragraphs were written the strongest evidence against their accuracy has been advanced from several quarters. Dr. Lewis, whose work in connection with cholera in India has been already referred to, has demonstrated that a spirillum in all its microscopic characters undistinguishable from Koch's cholera bacillus is to be found in the saliva of healthy persons and the English Cholera Commission, consisting of Messrs. Klein and Heneage Gibbes, as the result of their investigations both in Bombay and Calcutta, where they have gone over the same ground as Koch, have shewn that his bacillus is found in other cases besides those of cholera. Moreover comma bacilli have been found in the same tank in which Koch found them, and yet for many months there has not been a case of cholera among the people who use it. The whole superstructure which the German Cholera Commission raised on the supposition that the comma bacillus is an organism peculiar to cholera, and which was viewed with such ready approval both by the public and great part of the medical profession, has in fact tumbled to the ground.

CHAPTER IV.

Practical Conclusions.

The evidence accumulated in the preceding chapters shows that the outcry against India is altogether unreasonable.

THE statements which have been made in the preceding chapters are either true or they are untrue. If they are untrue, then let the errors be pointed out; but if they are true, they cannot be set aside as of no importance. Great facts all telling the same general story are not to be ignored because little seeming facts all on the one side appear to tell a different story. No one of ordinary intelligence can be satisfied with the usual reply that the questions to which they refer have all been settled; that the spread of cholera by human intercourse and by the infection of the healthy from the sick are facts regarding which there is no room for dispute; that they are truths which cannot be impugned by any amount of data or arguments to the contrary. For, if the evidence accumulated in the preceding chapters is unshaken, it follows as a matter of course that they are not truths, that they are merely theoretical assertions entirely at variance with all the great facts regarding cholera both in India and in other countries, and that they must be rejected. If it really be true that isolated cases of undoubted cholera, disguised under the name of "cholera nostras," occur now and again every year in almost every part of the world, there is no room for the theory that the delta of the Ganges is the home of

cholera. It certainly is the place where the disease is most common and constant, but it is not the home of cholera in the sense of being the only place where it is born and bred. Or setting aside these cases as evidence in regard to which there is great divergence of opinion, is it true that during the last twenty years cholera in an epidemic and unmistakeable form has been present in one or other part of Europe in at least thirteen of those years? This fact, as already shown, is vouched for by Mr. Netten Radcliffe, and in the pages of the *Lancet*, both well-known supporters of the commonly-accepted beliefs, so that there is no reason to question its accuracy. But if it is true, what necessity is there for endeavouring to show that cholera is brought from India? If it is so commonly present within a day or two's journey of every capital of Europe, what need is there for inventing the tale that it is brought all the way from the delta of the Ganges? Again, if it be true that there is no relation either in India or other countries between the progress of cholera and human traffic, either as regards its direction or the pace at which it travels, what connection can there be between the advance of an epidemic and the movements of man? In the face of all the facts, and especially of the facts concerning recent years, the history of which is most accurately known and is most striking, the outcry against India as responsible for all the miseries which the human race has to undergo in respect of cholera is altogether groundless. It would just be as reasonable to attribute the extraordinary

heat of this summer in many parts of Europe to importation from the East, and the strictest quarantine at Suez would just be as likely to prevent the one as it would be to prevent the other.

The practical action to be taken is best guided by experience.

It will be said that all this criticism is simply destructive. It tells nothing. It says that all the ordinary views held regarding cholera are wrong, but it puts nothing else in their place. This no doubt is true so far as theories are concerned, but it must be remembered that this is not a theoretical question but a practical question. What has to be determined is, not what ought to be believed, but what ought to be *done*. In this point of view, it is indispensable that what is known should be separated with the greatest care from what is not known, and that a broad view should be taken of the whole subject. The facts recorded in India and elsewhere must be the basis of action, and not the basis of theories which either do not accord with those facts or are altogether impracticable. In other words, experience must be the guide. This has been the policy of the Government of India. It has acted on no theory of contagion or non-contagion, but only on the common-sense plan that certain measures in respect of cholera have proved in practice to be most useful, and that other measures, although strongly advocated on theoretical principles, have proved not only useless but positively mischievous. The practical experience of India altogether negatives the theoretical views of the day, and teaches exactly

the same lesson as the great facts in other countries which have been cited in a previous chapter. The question to be answered is twofold—what should the State do to prevent cholera and, what is just as important, what should it *not* do?

What ought the State to do to prevent cholera?

What, then, ought the State to do to prevent cholera? This is a question which applies not only to India but to all other countries where the disease is known, and it is one in which the experience of India is of the greatest value. Sanitary improvements, and sanitary improvements alone, embrace the whole action which a Government can take in order to prevent cholera. And these sanitary improvements are to be directed, not to remedy *one* evil only, and leave all the other evils unremedied, but to remove every evil as far as possible. Pure air, pure water, pure soil, good and sufficient food, proper clothing, and suitable healthy employment for both mind and body, these are the great requisites for resisting the cause or combination of causes which produces cholera. The avoidance of overcrowding is just as important as the provision of pure water; good drainage and good conservancy are essential, just as it is essential that the people should be well housed. In all these matters the State may give most valuable aid. The Government of India has endeavoured to carry out these principles, with what success among its troops and prisoners has been already shown. In regard to the general population of India the difficulties are very great; the number is

so large, the area so vast, and the natural obstacles to sanitary improvement in the way of climate and physical difficulties and other causes so hard to deal with. In all matters connected with sanitary improvement among the general population, the State, as has been already said, may render most valuable aid, but much depends on the people themselves. It is therefore of the greatest importance that they should be educated in sound sanitary principles. In the schools throughout India the children are taught the simple Primer[1] which was introduced a few years ago, and as the new generation grows up, there is every reason to hope that great progress will be made. Already there are undoubted signs that the people of India appreciate the advantages of sanitary improvements much more than they did, and in many towns and municipalities endeavours are being made to remove causes which have been injurious to the public health. In European countries the difficulties are not by any means so great as they are in India, and in most of them overcrowding, filth in all its forms, and other causes of disease are too well known to need description. Let the money which is now spent on useless quarantines and on other measures which are a curse to mankind in general, and especially to the countries where they are carried out,—let this money be spent on sanitary improvements, and then there will be some solid benefit to show for it.

[1] A Sanitary Primer for Indian Schools, by Dr. J. M. Cuningham, Sanitary Commissioner with the Government of India, 1879.

Sanitary improvements are the only safeguard against cholera.

The supporters of contagion doctrines, and the believers in quarantine and isolation and disinfection as a means of preventing cholera, will no doubt say that the striking reduction of the disease among troops and prisoners in India, on which so much stress has been laid, is really to be explained by the measures of this kind which are authorised by the regulations, and which have been carefully taken by medical officers. But this argument cannot hold good, for quarantine has been absolutely prohibited in cantonments for many years. Under the most favourable circumstances it was never really a quarantine at all, for hundreds of people passed in and out every day to bring grass and other supplies for the troops. In jails, in the same way, the quarantine has been quarantine merely in name, and the intention of it has been not to cut off communication with the outer world which is an impossibility, but merely to direct special attention to new arrivals as requiring more than ordinary care. Even if quarantine had been a fact both for cantonments and jails, the mere coincidence that cholera had at the same time abated in an extraordinary degree would be by itself an argument of little value. It must be shown that the danger existed around, and that it had been averted by quarantine. If an engineer were to say that a city required an embankment to protect it from floods, and were to induce the authorities to act on his advice, it would not be sufficient for him at the end of the rainy season, as confirmation of the wis-

dom of his opinion, to point to the escape of this city as evidence that the embankment had proved its safety. It would be necessary for him to show that the floods came, that the water was held back by the embankment, and that otherwise it must have descended on the inhabitants. There is no evidence of this kind in the case of quarantine, either for a jail, or a town, or a tract of country; and as for isolation of the sick and disinfection of the discharges, the case is altogether similar. There is abundant evidence to show that they are valueless, and, as far as the regulations are concerned the best evidence that they have been found wanting is the fact already mentioned, that removal from the *affected* [not *infected*] *locality*, is peremptory. Thus, though the practice in regard to troops and prisoners in India is slightly different from what it is among the people generally, this difference arises not because of any difference of principle, but because of difference of circumstance. There is no danger here of causing oppression or social misery. The bodies are under complete control, and hence it is quite easy to carry out that change of locality which has been found so successful with troops and prisoners, but which it would be extremely difficult, if not impossible, to carry out among the ordinary inhabitants of any country. Sanitary improvements to prevent cholera and movement, if an outbreak unmistakeably threatens—these are the two and only safeguards as shown by all Indian experience. Nor will these safeguards completely banish cholera any more than they will com-

pletely banish other diseases, but they will do more than anything else that can be done, and they will do it without interfering with the liberty and happiness of the people. It has been said that England objects to quarantine only because quarantine is such a hindrance to trade; that her action in this matter is purely selfish and that she cares not what dangers the world at large is exposed to from India, so long as her commerce is not interfered with. But such assertions are altogether contradicted by the fact that in India, where her own interests are so directly concerned in preserving the health of the European troops, the same procedure is adopted as is recommended to other countries and quarantine is prohibited, for the very sufficient reason that it has been found to do no good and to do much harm.

Even if the contagion doctrine were true, no practical action can be based on it.

What more can the believers in contagion do so as to act up to their beliefs? Many of them discard quarantine. They say it is theoretically correct, but that it is practically impossible and therefore useless. They would isolate the sick on the supposition that every sick person is in reality a manufactory of bacilli or other germs. He is producing millions of them, therefore he is to be isolated, or in other words put in confinement, to the great misery of his friends and often of himself; and with all this no good comes of it, or of the disinfection of these supposed innumerable germs. Such measures never checked an outbreak of cholera and never can, while the experience of attendants shows they are not wanted. Again, the believers in

germs or other forms of contagion would defend the water-supply as being the medium specially liable to be contaminated by them, and specially likely to disseminate them on a large scale. But sanitary improvements include a good water-supply, and would protect it not only from cholera germs but from every form of pollution, and they would at the same time provide for all the other requirements of health which the doctrine of contagion proclaims to be unnecessary. In practice, therefore, nothing comes of the contagion doctrine. The believers in it can base no practical action on it—nothing which does not already flow much more logically and thoroughly from acceptance of the great truth that sanitary improvements are the best and only antidote to cholera.

What the State ought *not* to do. There should be no quarantine.

It remains to consider what measures the State ought *not* to take in the hope of preventing cholera. The answer to this question has been in great part already anticipated. First of all there ought to be no attempt at quarantine. On this point the experience of India and of all other countries is most valuable. As already stated, all attempts at quarantine in India have signally failed to afford protection. But it is urged that because land quarantine is an impossibility, it by no means follows that quarantine is impossible in the case of ships. What, then, has been the experience of those countries in which it has been tried for years? Have they suffered less from cholera than those countries in which there has been no quarantine?

Or what has been the experience of the present epidemic? Was Mecca protected, or Egypt, or France, or Italy? So far they have all suffered, while England without quarantine, and having of all countries the most direct and constant intercourse with the East so far as an epidemic is concerned, has hitherto escaped. And yet in spite of this experience, which all tells the consistent story of signal and utter failure, the same thing goes on, with all its worries and annoyances just as if it ever had done, or ever could do any good. The Sanitary Boards at Constantinople and Alexandria decide when quarantine is to be imposed and when it is to be taken off. Their action is extraordinary and past all understanding. It is impossible from day to day to predict what the next move will be. To begin with, they assume that a time of cholera prevalence at or near any Indian port is a time of special danger to Europe, although this assumption is opposed to experience. They ignore the fact that in nearly all the ships which they put in quarantine as sources of contamination, the complete immunity from cholera of the passengers and crew who have been in these ships for many days is itself ample evidence that there is no such danger as is imagined. To-day there is a quarantine against Bombay, tomorrow it is against Calcutta. In a few weeks it is withdrawn from one or both, to be reimposed in just as arbitrary a way as before. They insisted on quarantine at Suez against Indian arrivals when the disease was already epidemic in Egypt. They insisted on arrivals from

Sumatra being quarantined at Calcutta otherwise Calcutta would be compromised, although there was at the time far more cholera in Bengal than there was in Sumatra. They required quarantine at Busrah to protect Turkey in Asia against the importation of cholera, and yet, so far as is known, there has never been a sign of cholera on board a ship going from India to Busrah. They required quarantine at Indian ports against the importation of plague from the Persian Gulf, otherwise Indian ports would be compromised. The so-called plague was a purely local outbreak, and as was foreseen, it never attempted to move by ship to any other part of the world. Indian pilgrims are subjected to all the delays and extortions of quarantine on the Island of Camaran, while the demands for passports and visas and for more stringent bills of health are only so many measures of interference and annoyance, all of which are based on merely theoretical doctrines. The proceedings of these boards have in fact been so illogical that there seems to be no explanation of them, except that it was necessary for them to appear to be doing something in order to justify their own existence.

There should be no cordons.

In the second place, there should be no cordons. These are generally called sanitary cordons, but they are the very reverse of sanitary. They are cruel and oppressive, and do a vast amount of harm. If it be true—and all experience shows it is true—that cholera is a disease of locality, nothing could well be more inhuman than to force people to remain in a cholera locality. Ex-

perience in Egypt showed what misery was entailed by this means. All endeavours of this kind have been given up in India long ago. Avoid any *locality* where cholera exists. Escape from that *locality* is the best means of safety. This is the teaching of all Indian experience. On this principle, if cholera exists at or near a place of pilgrimage people are advised not to go there, because it is a place of danger. If it breaks out at a fair or other gathering, the people are dispersed because the place is dangerous. But all attempts to coerce the people—to prohibit their going here or going there have been forbidden. The last correspondence on this subject took place with the Government of the North-Western Provinces. They desired to issue restrictive orders of this kind; they pointed out that in 1879, in consequence, they believed, of the great Hurdwar fair, cholera had been very prevalent, and that it was therefore most desirable to prevent the recurrence of such a calamity. The reply was very simple. No doubt there had been considerable cholera prevalence in the North-Western Provinces and Oudh during 1879, and much attention had been directed to it on account of its supposed connection with the Hurdwar fair, but in 1880 the Hurdwar fair had passed off without any cholera. There was not the smallest suspicion that cholera had been diffused by that fair or any other gathering. The epidemic of 1880 had in consequence attracted no attention, and yet in the North-Western Provinces and Oudh it caused exactly double the mortality which the epidemic of 1879 had caused.

There should be no forced isolation of the sick or disinfection.

Even among the troops and prisoners in India, there is no ground for supposing that isolation of the sick and disinfection have done any good. They have, on the other hand, done harm, because they have caused alarm. Men and women and children have been carried off to hospital, have died and have been buried, without seeing those who were nearest and dearest to them. The one duty inculcated by the action taken has been the duty of avoiding infection. The far higher duty of husband to wife or of wife to husband, or of both of them to their children,—the duty imposed by ties of relationship and by ties of friendship,—has been often practically ignored. In the towns and villages of India where any such system has been attempted, the results have been most unfortunate. Even if the system were beneficial, the people have no means of carrying it out. An enthusiastic Sanitary Commissioner in one of the provinces, who was a firm believer in the *contagion* of cholera, recommended, in a set of rules which he issued, that if a case of cholera occurred, the discharges should all be carefully collected in an earthen pot and boiled over the fire, so that the vitality of the germ they are supposed to contain might thereby be destroyed. The picture of a poor Indian villager boiling cholera discharges would be very ludicrous, if the promulgation of such impractical suggestions did not do much mischief, but fortunately the suggestion is so foreign to the habits of the natives that it never could have been acted on. The forcible

taking away of the sick has caused much misery. But now everything of this kind is forbidden.

Experience of Simla in 1875.

The experience of Simla in 1875 is a very excellent illustration of the evil of one system and of the good which may be done by another system :—

"When the disease first appeared, a cholera hospital was established, and endeavours were made to remove to it every person that was attacked. This procedure was based on the idea that cholera is contagious, that the disease is spread by discharges, and that, therefore, the public safety would be best consulted by isolating all who are seized. But it altogether failed in practice. The people feared cholera, but they feared the cholera hospital still more. It was but natural that they should dread the removal of their friends or members of their family to a hospital to be tended by strangers, especially when there was so little hope of ever seeing them again. The consequence was that every effort was made to conceal the disease, and hence, instead of diminishing the sources of supposed contagion, they were only increased. After a time an altogether different system was adopted. The settlement was divided into districts, each district was provided with a supply of medicines and a hospital assistant, people were encouraged to apply for remedies at the first onset of any premonitory symptoms, and the cholera hospital was reserved for those who had no friends to look after them. When it was known that those attacked would not be carried off to the cholera hospital against the wishes of their friends, applications for medicine were numerous, and in this way many cases were checked in their early stage. The sick were attended in their own houses, and measures were adopted for disinfection so far as they could be carried out. There is not the smallest ground to believe

that treating the sick in this way in the least degree spread the disease. The four medical officers at Simla who have been brought in immediate contact with cases since the new system came into play, have all recorded that in the whole of their experience during this outbreak they have never seen any ill effects from the sick being treated in their own houses, and that in their opinion it has not in a single instance spread the disease. The sick have, in fact, not acted as sources of contagion from which others have become affected. On the other hand, there can be no question of the advantage to those attacked in being left at their homes. Not only did they meet with care and comfort there, which they could have had nowhere else, but they were also spared the fatigue and other depressing influences of removal to hospital which are so full of danger to a cholera patient. As the attempt to remove cholera patients from their homes, which failed at Simla, has been tried elsewhere with the same want of success and the same distress to the people, it is most important that these facts should be known, not only throughout India, but also in other countries, where belief in the contagion of cholera has gained much ground both with the profession and the public, and where compulsory measures of isolation have been advocated in order, as it is called, to 'stamp out' the disease, and that it may be seen how needless is the social misery which any such system must inevitably entail." [1]

Proper method of managing an outbreak.

The practical lessons to be learnt from this and other outbreaks are that the great objects should be—

(1) to quiet alarm by assuring the people that, if attacked, they will not be carried off to a

[1] Eleventh Annual Report of the Sanitary Commissioner with the Government of India, for 1874, pages 19 and 20.

hospital against their will, but that they may be treated in their own homes, care being taken to avoid if possible, the room they occupied *when attacked;* and if the house can be changed, so much the better:

(2) to impress on all that the sick can be attended without the smallest danger: and

(3) to have convenient places where people can procure medicines and medical attendance without delay.

Let them practise isolation and disinfection if they like. These can do no harm so long as the sick are not dreaded and neglected, but anything in the shape of an enforcement of these measures on the part of the authorities is very much to be deprecated as calculated greatly to increase the evil it is intended to mitigate.

The whole practical question is summed up.

The relation of man to an outburst of cholera very much resembles the relation of a ship to a cyclone. Cyclones are met with most frequently in the East, but they are not unknown in other seas. They are not carried by man, nor can they be prevented by man. To meet them the ship must be well built, well found, and well commanded; and when in spite of all these advantages the storm is greater than she can well bear, she must endeavour to get away from the area which it covers. What a blessing it would be to the human race if those who are responsible would prepare to meet cholera in the same way as the intel-

ligent commander of a ship is prepared to meet a cyclone! All interference with liberty in this matter would then be at an end—all that tyranny and oppression which are so often perpetrated in the name of truth and science. To sum up the whole matter, the doctrine that cholera is communicable or transmissible from man to man leads to no practical benefit. On the other hand, it leads to all the evils of quarantine, loss of personal liberty, worry and annoyance, social misery and anxiety, with grievous injury to trade. Panic is caused, the sick are not properly attended to, and, what is most to be lamented, sanitary improvements are neglected—the real evils of filth in every form remain, and money which might have been spent with so much profit to remove or remedy these evils has been more than wasted on the quarantine officials. If all nations will not admit the truth of what has been said, let Egypt and every other country take such measures as it may think proper to protect itself, let ships go through the Suez Canal in quarantine, and then it will soon be seen which countries fare best. There is no need for International Sanitary Boards such as now sit at Constantinople and Alexandria, nor indeed is there anything useful to be done by them. Their proceedings have invariably led to evil, they have never led to good. Each country should have its own sanitary administration, which should be occupied entirely with carrying out sanitary improvements within its own boundaries, and with collecting information to show where these are most wanted, and what results they

have produced. If it is to be of any value, the whole practical action must be based on the great truth that the measures which will confer protection from cholera are measures directed not against the freedom of the *person*, but against the insanitary conditions of the *place* in which he lives. Such measures will not only diminish cholera, but they will also diminish the many other diseases which, though less alarming, are by their constant drain on the population in reality much more destructive than cholera. Once accept the great principle that the improvement of local conditions is the one and only principle on which the State can act with advantage in matters of public health, and the solution of the whole question will be comparatively easy. Sanitary administration will then no longer attempt to accomplish impossibilities, but will be directed to those great practical reforms which cannot fail to improve the health, and thereby add to the happiness and prosperity of the people.

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Appendix A.

Statements shewing the Distribution by Months of the Deaths Registered from Cholera in India during the 12 years 1871-82.

No. I.

Districts forming the central portion of the Endemic Area.

Serial Number.	District.	Average Population.	Number of Deaths from Cholera registered in each Month.											Total number of deaths.	Average annual death-rate per 10,000 of population.	Maximum number of deaths in any one of the 12 years.	Minimum number of deaths in any one of the 12 years.	Number of years in which the death-rate exceeded 1 per 10,000.
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.					
1	24-Pergunnahs and Calcutta with its Suburbs .	2,480,363	9,441	7,778	11,148	10,291	6,627	3,205	1,447	1,377	1,463	2,298	6,351	13,628	75,054	25·22	10,934	794	12
2	Howrah . . .	683,219	1,969	1,674	2,066	1,594	1,181	709	405	370	596	790	1,439	2,825	15,618	19·05	1,893	393	12
3	Serampore and Hooghly .	885,133	799	861	1,421	2,058	818	399	298	358	406	501	883	1,538	10,340	9·74	1,473	454	·12
4	Nuddea . . .	1,915,321	5,222	3,869	10,301	13,119	5,950	997	439	162	291	1,287	7,668	9,877	59,182	25·75	11,020	528	12
5	Jessore	1,826,135	8,872	3,358	6,957	12,373	6,007	1,682	702	265	295	2,097	9,902	16,737	69,247	31·60	14,822	1,906	12
6	Burdwan . . .	1,713,284	2,346	2,447	5,059	5,823	3,592	2,323	1,247	880	524	468	680	2,189	27,578	13·41	5,276	144	11
7	Dacca	1,984,672	5,691	2,068	2,786	7,813	3,263	867	398	745	858	2,095	9,251	13,734	49,569	20·81	11,257	427	12
8	Furreedpore . . .	1,322,161	3,193	1,240	4,098	9,057	2,678	475	190	338	301	2,612	7,386	8,309	39,877	25·13	14,135	303	12
9	Backergunge . . .	2,139,161	14,692	4,877	5,760	8,848	7,601	2,152	694	312	203	736	2,328	14,238	62,441	24·32	19,177	291	12
10	Mymensingh . . .	2,700,942	3,993	2,204	1,507	3,265	3,790	1,860	619	393	449	1,963	6,636	9,214	35,893	11·07	7,979	250	12
11	Moorshedabad . .	1,290,208	1,403	1,727	3,656	5,495	3,131	1,232	391	213	276	897	2,490	2,652	23,563	15·22	4,063	539	12
12	Dinagepore . . .	1,508,135	1,210	517	847	2,111	2,016	801	680	241	207	145	572	1,605	10,952	6·05	2,306	214	12
13	Maldah	693,437	701	422	1,254	3,884	2,584	561	288	177	69	416	1,626	1,752	13,734	16·50	4,401	52	11
14	Rajshahai . . .	1,324,684	850	377	1,198	6,465	3,221	493	106	96	118	1,156	2,649	2,887	19,616	12·34	3,330	161	12
15	Rungpore . . .	2,123,968	2,168	869	1,289	3,310	3,960	1,884	1,265	886	435	1,078	2,802	4,735	24,681	9·68	5,664	49	11
16	Bogra	711,912	456	140	356	1,502	819	226	189	67	296	1,083	2,851	1,498	9,483	11·10	1,888	104	12
17	Pubna	1,261,661	1,027	322	1,016	4,394	1,726	301	91	53	230	2,366	6,403	4,807	22,736	15·02	3,937	312	12
18	Purneah . . .	1,781,741	228	740	4,171	12,562	5,265	1,009	459	341	429	755	1,701	963	28,623	13·39	8,870	117	10
19	Noakhally . . .	767,353	12,460	7,317	3,084	1,957	977	267	108	190	95	139	5,685	13,312	45,591	49·51	21,858	75	11
20	Tipperah . . .	1,526,635	3,537	2,242	2,761	3,168	1,935	534	177	104	52	242	1,936	4,331	21,019	11·47	3,488	359	12
	Total .	30,640,125	80,258	45,049	70,735	119,089	67,141	21,977	10,193	7,568	7,593	23,124	81,239	130,831	664,797	..	...	...	...
Average Death-rate of each Month per 10,000 of Population			2·18	1·22	1·92	3·24	1·83	·59	·28	·21	·21	·63	2·21	3·56	=18·08				
Percentage of Deaths in each Month . .			12·1	6·8	10·7	17·9	10·1	3·3	1·5	1·1	1·1	3·5	12·2	19·7	=100				

No. II.

Districts situated towards the margin of the Endemic Area.

Serial Number.	District.	Average Population.	Number of Deaths from Cholera registered in each Month.											Total number of deaths.	Average annual death-rate per 10,000 of population.	Maximum number of deaths in any one of the 12 years.	Minimum number of deaths in any one of the 12 years.	Number of years in which the death-rate exceeded 1 per 10,000.
			January.	February.	Marc	April.	May.	June.	July.	August.	September.	October.	November.	December.					
21	Bancoorah . . .	784,262	440	767	1,13	825	1,236	1,158	968	580	224	96	208	497	8,162	8·67	1,954	38	11
22	Beerbhoom . . .	745,175	800	1,445	2,89	1,962	1,651	1,580	672	690	250	146	400	954	13,409	15·00	3,996	80	12
23	Midnapore . . .	2,529,382	2,478	4,321	4,89	2,962	2,181	2,852	2,731	1,014	474	560	1,190	2,476	28,088	9·25	5,627	68	11
24	Balasore . . .	857,756	1,601	1,845	4,10	4,493	5,866	6,944	5,195	1,041	457	740	1,612	2,388	36,302	35·27	7,361	49	11
25	Cuttack . . .	1,616,474	1,617	1,914	4,57	4,852	5,173	5,918	6,225	3,101	2,510	2,513	3,494	3,506	45,370	23·39	7,296	124	11
26	Pooree . . .	829,081	856	1,711	4,51	3,080	3,570	5,119	5,526	2,103	891	710	1,965	2,430	32,512	32·68	7,569	9	11
27	Rajmahal and Deogarh .	1,413,690	191	194	84	1,137	1,611	1,751	1,998	1,315	697	370	578	194	10,920	6·44	2,096	114	10
	Total .	8,775,820	7,983	12,197	22,913	19,311	21,288	25,322	23,315	9,844	5,503	5,135	9,447	12,445	174,763	...	...	...	...
	Average Death-rate of each Month per 10,000 of Population		·76	1·16	2·18	1·83	2·02	2·41	2·21	·94	·52	·49	·90	1·18	6 =16·60				
	Percentage of Deaths in each Month . .		4·6	7·0	13·1	11·1	12·2	14·5	13·3	5·6	3·2	2·9	5·4	7·1	=100				

No. III.

Districts of Bengal and the North-West Provinces situated between the Endemic and Epidemic Areas.

Serial Number.	District.	Average Population.	Number of Deaths from Cholera registered in each Month.											Total number of deaths.	Average annual death-rate per 10,000 of population.	Maximum number of deaths in any one of the 12 years.	Minimum number of deaths in any one of the 12 years.	Number of years in which the death-rate exceeded 1 per 10,000.
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.					
28	Manbhoom	1,026,899	48	205	433	750	2,141	3,249	2,198	867	145	90	52	64	10,242	8·31	2,936	51	10
29	Hazaribagh	938,308	2	30	213	312	356	907	1,856	1,962	831	270	41	3	6,783	6·02	2,444	61	11
30	Ranchee	1,423,184	18	23	66	184	617	1,707	3,633	4,545	1,420	173	51	37	12,474	7·30	5,566	28	6
31	Chybassa	488,493	32	75	196	173	113	821	808	258	82	46	48	39	2,691	4·59	1,476	5	9
32	Monghyr	1,891,380	16	24	453	3,044	6,991	7,699	3,920	2,175	742	734	494	349	26,641	11·74	6,999	177	11
33	Bhaugulpur	1,896,224	32	106	2,579	8,185	5,119	2,922	3,530	3,216	1,618	1,242	711	221	29,481	12·96	7,719	196	12
34	Gya	2,037,216	28	38	326	1,684	4,383	8,177	10,914	6,595	2,297	870	321	119	35,752	14·62	10,107	285	12
35	Patna	1,658,080	53	33	508	2,729	4,432	5,993	6,910	4,059	816	381	260	168	26,342	13·24	5,078	288	12
36	Shahabad	1,844,441	129	110	169	1,254	4,781	6,319	6,482	4,915	1,529	881	227	184	26,980	12·19	6,619	62	11
37	Sarun	2,172,121	24	45	49	466	1,698	3,356	4,274	5,154	2,478	689	239	107	18,579	7·13	3,534	222	12
38	Tirhoot and Darbhanga	4,800,107	71	65	269	4,540	15,545	21,313	13,915	10,561	4,004	1,517	470	113	72,383	12·57	23,025	85	11
39	Chumparun	1,581,211	24	3	113	1,758	2,840	3,965	4,505	9,341	4,939	812	102	...	28,402	14·97	5,362	30	11
40	Ghazipur and Ballia*	1,635,633	32	90	154	1,184	2,919	3,721	3,911	2,875	1,179	500	140	83	16,788	8·55	5,647	126	11
41	Benares*	842,980	301	365	1,073	2,649	2,000	1,818	1,774	1,493	695	420	161	154	12,903	12·76	2,125	251	12
42	Mirzapur*	1,095,605	81	85	771	2,733	3,004	3,786	2,719	1,442	665	176	52	29	15,543	11·82	3,612	109	12
43	Azamgarh*	1,495,263	37	65	421	3,393	3,566	3,349	3,237	3,018	1,613	1,098	207	45	20,049	11·17	3,673	224	12
	Total	26,827,145	928	1,362	7,793	35,038	60,505	79,102	74,586	62,476	25,053	9,899	3,576	1,715	362,033	...	...	...	...
	Average Death-rate of each Month per 10,000 of Population		·03	·04	·24	1·09	1·88	2·46	2·32	1·94	·78	·31	·11	·05	= 11·25				
	Percentage of Deaths in each Month		·3	·4	2·1	9·7	16·7	21·8	20·6	17·3	6·9	2·7	1·0	·5	= 100				

* In the North-Western Provinces.

No. IV.

Eastern Districts of the North-Western Provinces and Oudh (excluding the Districts of the North-Western Provinces contained in No. III).

Serial Number.	District.	Average Population.	Number of Deaths from Cholera registered in each Month.											Total number of deaths.	Average annual death-rate per 10,000 of population.	Maximum number of deaths in any one of the 12 years.	Minimum number of deaths in any one of the 12 years.	Number of years in which the death-rate exceeded 1 per 10,000.
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.					
44	Jaunpur . . .	1,112,545	115	134	1,716	8,803	2,210	1,079	610	555	440	263	73	25	16,023	12·01	8,251	15	10
45	Gorakhpur . . .	2,300,468	19	48	745	10,764	6,449	4,541	2,713	2,132	2,686	3,714	945	160	34,916	12·65	8,314	61	11
46	Basti	1,543,154	31	41	2,464	15,730	10,738	7,011	2,384	624	187	850	1,112	677	41,849	22·60	9,537	49	10
47	Allahabad . . .	1,433,645	301	203	701	3,205	3,271	2,650	960	761	322	198	87	24	12,683	7·37	3,615	15	11
48	Futtehpur . . .	682,265	33	53	27	93	631	1,452	700	630	316	179	22	6	4,142	5·06	917	4	8
49	Partabgarh . . .	891,550	194	221	1,635	5,153	2,158	1,086	667	253	2	1,786	1,287	356	15,448	14·44	6,129	...	10
50	Rai Bareilly . . .	867,389	147	44	142	525	4,367	6,300	2,325	1,699	502	1,324	1,420	861	19,656	18·88	6,635	4	9
51	Sultanpur . . .	943,967	414	447	2,088	7,650	3,007	2,402	1,195	534	257	1,264	3,365	2,962	25,585	22·59	5,704	2	9
52	Fyzabad	1,259,214	102	195	1,342	6,204	3,815	1,716	1,152	628	205	562	1,529	689	18,139	12·00	3,135	25	11
53	Unao	812,009	2	6	13	820	1,196	1,785	1,023	1,067	467	230	52	203	6,864	7·04	1,926	2	9
54	Barabanki . . .	951,082	35	56	269	2,340	2,072	1,567	1,342	1,819	1,047	2,015	2,004	602	15,168	13·29	4,612	8	9
55	Gonda	1,219,371	36	59	1,048	6,820	7,751	5,677	2,823	1,434	1,169	985	387	162	28,351	19·38	6,122	...	10
56	Bahraich . . .	826,243	1	13	176	3,884	2,696	2,309	1,445	1,745	1,199	1,018	293	67	14,846	14·97	3,376	1	9
57	Kumaon . . .	439,715	89	249	311	1,955	3,784	2,805	596	154	36	43	111	221	10,354	19·62	6,894	1	6
58	Dehra	123,451	...	1	...	230	668	105	64	175	11	9	...	...	1,263	8·53	·636	...	3
59	Garhwal	327,788	10	2	3	597	1,720	1,436	852	104	18	...	6	15	4,763	12·11	3,473	...	3
	Total .	15,733,856	1,529	1,772	12,680	74,773	56,533	43,921	20,851	14,314	9,514	14,440	12,693	7,030	270,050	...	...	...	...
	Average Death-rate of each month per 10,000 of Population		·09	·09	·67	3·96	2·99	2·33	1·11	·76	·50	·76	·67	·37	=14·30				
	Percentage of Deaths in each Month .		·6	·7	4·7	27·7	20·9	16·3	7·7	5·3	3·5	5·3	4·7	2·6	=100				

No. V.

Western Districts of the North-West Provinces and Oudh (excluding Agra and Muttra).

Serial Number.	District.	Average Population.	Number of Deaths from Cholera registered in each Month.											Total number of deaths.	Average annual death-rate per 10,000 of population.	Maximum number of deaths in any one of the 12 years.	Minimum number of deaths in any one of the 12 years.	Number of years in which the death-rate exceeded 1 per 10,000.
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.					
60	Cawnpore . . .	1,185,129	20	15	26	263	897	1,261	877	1,528	1,381	934	83	7	7,292	5·13	1,609	23	9
61	Lucknow . . .	833,725	20	13	80	692	859	1,372	1,268	2,082	795	519	743	439	8,882	8·88	1,795	6	11
62	Hardoi . . .	959,303	21	2	14	166	266	1,396	2,302	5,109	2,090	1,609	218	26	13,219	11·48	5,997	1	4
63	Sitapur . . .	944,238	47	61	415	1,760	1,684	1,121	2,035	5,091	3,105	1,864	596	96	17,875	15·78	9,180	10	7
64	Kheri . . .	784,827	...	7	62	1,013	1,184	388	596	2,508	2,478	3,504	1,694	171	13,605	14·45	4,681	1	9
65	Fatehgarh . . .	911,776	14	9	20	38	235	411	716	1,859	1,402	723	31	14	5,472	5·00	2,538	2	3
66	Jalaun . . .	411,707	2	9	5	11	19	87	236	399	577	109	...	...	1,454	2·94	499	2	7
67	Etawah . . .	674,407	5	3	8	30	29	606	761	844	522	150	6	3	2,967	3·67	1,450	1	4
68	Jhansi . . .	322,500	...	...	...	2	1	13	66	510	222	12	...	...	826	2·13	353	...	3
69	Lalitpur . . .	248,617	...	...	11	14	26	137	261	46	35	148	8	...	686	2·30	502	...	2
70	Mainpuri . . .	750,718	2	1	1	10	69	566	877	619	734	116	24	2	3,021	3·35	1,771	...	4
71	Etah	685,437	9	7	12	22	107	222	413	671	825	389	49	5	2,731	3·32	1,861	6	4
72	Shahjehanpur . .	887,898	7	11	16	26	67	69	423	6,074	3,736	4,844	905	170	16,348	15·34	5,738	2	7
73	Budaon	898,131	17	23	46	65	114	65	262	772	2,735	3,183	274	61	7,617	7·07	3,552	22	9
74	Bareilly and Philibheet .	1,473,368	27	19	32	141	310	237	353	3,784	6,608	6,362	809	76	18,758	10·61	10,393	10	7
75	Moradabad . . .	1,125,239	26	47	56	173	124	101	147	1,256	2,176	1,394	79	17	5,596	4·14	1,131	18	9
76	Aligarh . . .	973,363	22	6	37	93	378	1,025	754	1,339	1,246	179	39	22	5,140	4·40	2,372	18	5
77	Bulandshahr . . .	862,651	11	6	27	57	264	465	195	1,310	1,941	191	9	9	4,485	4·33	2,381	4	5
78	Meerut	1,256,365	5	15	23	136	269	359	227	596	1,323	81	13	6	3,053	2·02	1,574	3	4
79	Bijnor	706,213	21	21	41	482	238	61	38	46	672	1,057	176	32	2,885	3·40	1,306	7	6
80	Muzaffernagar . .	720,316	11	17	24	211	134	92	70	204	347	51	2	6	1,169	1·35	561	1	4
81	Saharanpur . . .	923,014	26	15	41	644	235	174	73	868	812	145	22	30	3,085	2·79	1,351	1	4
82	Terai Pergunnahs . .	171,550	...	25	56	249	139	76	8	314	796	532	237	26	2,458	11·94	669	...	9
	Total .	18,710,492	313	332	1,053	6,298	7,648	10,304	12,958	37,829	36,558	28,096	6,017	1,218	148,624	...	...	...	...
	Average Death-rate of each Month per 10,000 of Population		·01	·01	·05	·28	·34	·46	·58	1·69	1·63	1·25	·27	·05	= 6·62				
	Percentage of Deaths in each Month . .		·2	·2	·7	4·2	5·2	6·9	8·7	25·5	24·6	18·9	4·1	·8	= 100				

No. VI.

Districts of Agra, Muttra and the Eastern portion of the Punjab.

Serial Number.	District.	Average Population.	Number of Deaths from Cholera registered in each Month.												Total number of deaths.	Average annual death-rate per 10,000 of population.	Maximum number of deaths in any one of the 12 years.	Minimum number of deaths in any one of the 12 years.	Number of years in which the death-rate exceeded 1 per 10,000.
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.					
83	Agra	1,001,600	7	14	37	239	322	603	648	691	768	297	48	12	3,686	3·07	869	13	6
84	Muttra	736,006	15	13	68	322	260	684	414	332	372	197	135	20	2,832	3·21	733	4	7
85	Gurgaon	666,185	1	1	6	97	396	371	209	326	272	25	28	2	1,734	2·17	753	...	5
86	Delhi	626,182	4	2	1	81	216	427	140	128	158	18	29	27	1,231	1·64	416	...	4
87	Rohtak	545,284	3	3	3	333	1,485	302	144	7	1	3	9	2	2,295	3·51	2,020	...	2
88	Hissar	494,432	2	...	1	994	2,302	414	45	56	17	67	1	...	3,899	6·57	3,674	...	3
89	Sirsa	232,035	...	...	...	175	680	249	86	31	3	1	1	...	1,226	4·40	1,088	...	3
90	Ferozepore	591,967	...	...	1	4	395	1,274	292	138	147	43	5	...	2,299	3·24	1,947	...	2
91	Karnal	616,774	...	2	4	214	1,552	713	101	187	142	3	3	...	2,921	3·95	1,606	...	4
92	Umballa	1,038,108	6	7	8	234	733	560	156	284	318	55	3	3	2,367	1·90	1,121	1	4
	Total . .	6,548,573	38	42	129	2,693	8,341	5,597	2,235	2,180	2,198	709	262	66	24,490	...	...	...	...
	Average Death-rate of each Month per 10,000 of Population		·00	·01	·02	·34	1·06	·71	·29	·28	·28	·08	·04	·01		=3·12			
	Percentage of Deaths in each Month . . .		·1	·2	·5	11·0	34·1	22·8	9·1	8·9	9·0	2·9	1·1	·3		=100			

No. VII.

The Western Districts of the Punjab.

Serial Number.	District.	Average Population.	Number of Deaths from Cholera registered in each Month.											Total number of deaths.	Average annual death-rate per 10,000 of population.	Maximum number of deaths in any one of the 12 years.	Minimum number of deaths in any one of the 12 years.	Number of years in which the death-rate exceeded 1 per 10,000.
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.					
93	Simla	38,559	...	...	...	14	14	6	181	55	4	...	...	...	274	5·92	158	...	3
94	Jullundur	786,288	...	1	2	39	32	11	31	762	474	76	3	3	1,434	1·52	865	...	3
95	Ludhiana	601,140	4	4	3	27	56	132	120	521	228	3	2	1	1,101	1·53	717	...	3
96	Hoshiarpur	920,135	...	3	5	27	40	58	37	409	636	172	4	...	1,391	1·26	724	...	3
97	Kangra	737,504	5	10	4	108	65	76	293	1,669	630	125	16	3	3,004	3·39	2,048	...	3
98	Gurdaspur	864,910	13	14	8	19	24	17	83	443	1,283	754	99	4	2,761	2·66	1,482	1	3
99	Sialkot	1,003,303	7	2	2	14	13	13	29	91	926	310	7	1	1,415	1·18	463	...	4
100	Amritsar	863,008	2	5	4	200	219	127	189	740	1,096	393	12	5	2,992	2·89	1,269	...	4
101	Gujranwala	583,734	1	2	1	5	64	93	189	317	589	75	2	2	1,340	1·91	430	...	4
102	Gujrat	652,731	3	1	2	5	93	224	85	268	356	51	2	5	1,095	1·40	572	...	3
103	Lahore	849,828	5	10	7	29	368	728	763	1,926	995	174	22	10	5,037	4·94	1,673	1	5
104	Montgomery	392,983	...	...	...	2	16	22	41	27	6	1	...	...	115	·24	101	...	1
105	Mooltan	505,872	...	...	1	...	2	...	1	...	...	33	...	...	37	·06	32	...	...
106	Muzaffargarh	317,076	...	...	...	...	1	...	...	3	1	1	...	...	6	·02	3	...	...
107	Dera Ghazi Khan	336,093	...	...	...	1	2	5	...	4	...	...	...	...	12	·03	5	...	...
108	Dera Ismail Khan	418,257	...	1	1	...	1	2	9	4	48	141	81	16	304	·61	240	...	1
109	Jhang	371,661	...	1	...	...	1	7	144	85	6	6	...	...	250	·56	242	...	1
110	Shahpur	395,152	...	...	...	...	8	254	348	92	30	...	...	...	732	1·54	504	...	3
111	Jhelum	545,180	...	...	1	124	548	820	291	537	213	58	...	2	2,594	3·97	1,962	...	3
112	Hazara	387,147	2	1	1	4	160	240	232	130	224	116	7	...	1,117	2·40	781	...	3
113	Rawal Pindi	760,080	...	...	2	50	535	1,165	972	641	348	75	26	1	3,815	4·18	2,914	...	4
114	Peshawar	546,558	...	1	1	4	384	219	264	84	126	929	198	...	2,210	3·37	1,002	...	4
115	Kohat	163,480	...	1	...	1	24	323	103	205	313	33	19	2	1,024	5·22	642	...	3
116	Bannu	310,062	1	...	...	...	...	1	536	100	24	417	95	...	1,174	3·16	998	...	2
	Total	13,350,741	43	57	45	673	2,670	4,543	4,941	9,113	8,556	3,943	595	55	35,234	...	...	...	...
	Average Death-rate of each Month per 10,000 of Population		·00	·00	·00	·04	·17	·28	·31	·57	·54	·25	·04	·00		=2·20			
	Percentage of Deaths in each Month		·1	·2	·1	1·9	7·6	12·9	14·0	25·8	24·3	11·2	1·7	·2		=100			

No. VIII.

Districts of Thur, Parkur and Sind.

Serial Number.	District.	Average Population.	Number of Deaths from Cholera registered in each Month.												Total number registered in the 11 years.	Average annual death-rate per 10,000 of population.	Maximum number of deaths in any one of the 11 years.	Minimum number of deaths in any one of the 11 years.	Number of years in which the death-rate exceeded 1 per 10,000.
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.					
117	Thur and Parkur*	214,172	...	..	7	19	19	121	30	1	...	...	...	...	197	·84	88	...	3
118	Shikarpur†	814,606	...	..	...	...	204	673	133	37	95	184	33	...	1,359	1·67	1,359	...	1
119	Kurrachee*	451,091	...	..	...	...	219	607	323	26	1	...	17	25	1,218	2·45	1,175	...	2
120	Hyderabad*	738,285	...	..	...	...	380	909	144	...	...	...	...	...	1,433	1·76	1,433	...	1
121	Upper Sind*	111,700	...	..	...	...	8	85	6	...	...	...	...	...	99	·81	99	...	1
	Total	2,329,854	...	..	7	19	830	2,395	636	64	96	184	50	25	4,306	...	...	...	...
	Average Death-rate of each Month per 10,000 of Population		...	..	·00	·01	·32	·93	·25	·03	·04	·07	·02	·01		=1·68			
	Percentage of Deaths in each Month		...	.	·1	·4	19·3	55·6	14·8	1·5	2·2	4·3	1·2	·6		=100			

* Statistics for 1871 not available.
† Statistics for 1871 and 1872 not available,

No. IX.

Districts forming the Eastern portion of the Central Provinces.

Serial Number.	District.	Average Population.	Number of Deaths from Cholera registered in each Month.											Total number of deaths.	Average annual death-rate per 10,000 of population.	Maximum number of deaths in any one of the 12 years.	Minimum number of deaths in any one of the 12 years.	Number of years in which the number of deaths exceeded 1 per 10,000.
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.					
122	Sumbulpur . .	319,894	18	193	486	303	129	958	632	419	357	153	23	27	3,698	9·63	1,581	...	9
123	Bilaspur . . .	612,093	...	88	341	1,090	4,143	4,322	3,804	1,925	317	18	38	41	16,127	21·96	8,040	...	6
124	Raipur . . .	991,752	76	117	322	2,496	9,008	8,931	7,228	3,487	855	337	239	3,132	36,228	30·44	17,076	...	8
125	Balaghat . . .	310,328	7	23	12	169	1,042	684	442	494	151	11	42	20	3,097	8·32	1,695	...	6
126	Jubbulpore . . .	431,063	35	86	43	314	973	1,109	854	683	282	54	39	...	4,472	8·65	1,697	...	5
127	Hoshangabad . .	444,109	34	15	100	494	1,069	1,256	635	345	207	111	19	12	4,297	8·06	2,371	...	5
128	Marwara . . .	211,849	18	36	29	180	338	256	187	166	112	...	...	...	1,322	5·20	722	...	5
129	Seoni . . .	378,192	7	75	50	66	711	1,061	808	1,005	256	57	115	12	4,223	9·31	1,976	...	5
	Total .	3,699,280	195	633	1,383	5,112	17,413	18,577	14,590	8,524	2,537	741	515	3,244	73,464	...	...	...	...
	Average Death-rate of each Month per 10,000 of Population		·04	·14	·31	1·15	3·92	4·19	3·29	1·92	·57	·17	·12	·73	=16·55				
	Percentage of Deaths in each Month .		·2	·9	1·9	7·0	23·7	25·3	19·9	11·6	3·4	1·0	·7	4·4	=100				

No. X.

Districts of the Western portion of the Central Provinces, Berar and the Eastern portion of the Bombay Presidency.

Serial Number.	District.	Average Population.	Number of Deaths from Cholera registered in each Month.											Total number of deaths.	Average annual death-rate per 10,000 of population.	Maximum number of deaths in any one of the 12 years.	Minimum number of deaths in any one of the 12 years.	Number of years in which the death-rate exceeded 1 per 10,000.
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.					
130	Saugor	531,796	58	85	7	33	120	488	1,690	1,464	274	313	58	...	4,590	7·19	2,975	...	5
131	Damoh	298,291	329	251	23	108	254	546	418	1,038	234	4	...	...	3,205	8·95	1,461	...	5
132	Narsingpore	350,985	3	3	...	3	81	1,742	2,323	1,404	394	239	47	...	6,239	14·81	4,192	...	5
133	Chhindwara	284,659	6	6	...	...	14	11	211	862	450	60	160	5	1,785	5·23	650	...	6
134	Betul	281,567	2	...	111	177	312	169	344	799	568	111	101	22	2,716	8·04	1,353	...	4
135	Nimar	139,755	...	...	49	237	222	399	414	1,102	419	107	29	3	2,981	17·78	1,385	...	6
136	Bhandara	646,144	109	118	56	895	964	879	1,227	1,138	887	316	296	67	6,952	8·97	2,281	...	7
137	Nagpur	673,349	2	9	42	95	270	306	1,623	3,799	1,924	559	488	32	9,149	11·32	3,425	...	6
138	Wardah	365,245	...	...	...	...	65	185	491	3,240	2,400	426	112	7	6,926	15·80	3,035	...	6
139	Wun	367,764	16	1	...	30	131	748	1,342	3,880	2,186	376	159	150	9,019	20·44	4,891	...	7
140	Chanda	474,598	17	...	122	279	1,294	1,810	1,692	1,737	826	117	152	67	8,113	14·25	3,248	...	6
141	Burhanpur	98,403	...	...	1	19	80	140	866	495	199	19	7	...	1,826	15·46	1,091	...	6
142	Bassim	309,894	16	...	...	22	912	4,753	4,527	2,852	1,008	313	149	90	14,642	39·37	11,698	...	8
143	Akola	536,725	...	...	29	34	270	3,199	4,890	4,949	1,287	205	142	39	15,044	23·36	7,847	...	8
144	Buldana	402,771	5	2	...	33	1,370	1,808	6,783	4,651	1,149	127	22	9	15,959	33·02	7,414	...	8
145	Amraoti	535,853	3	1	...	8	31	75	1,521	4,581	3,312	1,346	274	125	11,277	17·54	4,825	...	8
146	Ellichpur	233,268	...	...	...	...	...	136	1,682	1,457	262	71	7	6	3,621	12·94	2,107	...	6
147	Khandeish	1,104,743	18	1	11	30	1,022	2,514	6,219	8,610	1,683	104	104	72	20,388	15·38	6,224	...	8
148	Nasik	726,997	55	124	110	585	1,628	1,467	1,835	2,669	1,833	800	129	50	11,285	12·94	2,812	...	9
149	Ahmednagar	762,644	9	6	53	241	1,008	2,678	4,988	4,015	2,474	904	154	64	16,594	18·13	4,933	...	9
150	Sholapore	577,155	180	195	85	307	1,830	1,804	5,161	2,714	761	344	225	123	13,729	19·82	3,536	...	8
151	Satara	1,051,271	38	70	414	2,383	3,213	5,566	5,258	3,048	1,554	982	143	80	22,749	18·03	6,702	...	8
	Total	10,753,877	866	872	1,113	5,519	15,091	31,423	55,505	60,504	26,084	7,843	2,958	1,011	208,789	...	...	...	...
	Average Death-rate of each Month per 10,000 of Population.		·06	·06	·09	·43	1·17	2·44	4·30	4·69	2·02	·61	·23	·08	= 16·18				
	Percentage of Deaths in each Month		·4	·4	·5	2·6	7·2	15·1	26·6	29·0	12·5	3·8	1·4	·5	= 100				

No. XI.

The Western Districts of the Bombay Presidency.

Serial Number.	District.	Average Population.	Number of Deaths from Cholera registered in each Month.												Total number of deaths.	Average annual death-rate per 10,000 of population.	Maximum number of deaths in any one of the 12 years.	Minimum number of deaths in any one of the 12 years.	Number of years in which the death-rate exceeded 1 per 10,000.
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.					
152	Ahmedabad	842,981	43	82	548	1,404	2,304	2,077	451	756	163	52	177	106	8,163	8·07	2,818	1	7
153	Panch Mahals	251,528	33	4	86	970	1,859	2,146	400	28	1	...	117	54	5,698	18·88	4,130	...	5
154	Kaira	793,766	25	9	408	843	1,852	1,539	414	203	144	78	148	81	5,744	6·03	2,104	...	6
155	Broach	322,418	2	5	96	173	490	1,167	734	252	74	43	30	1	3,067	7·93	1,027	...	5
156	Surat	553,441	115	152	152	339	975	2,238	1,666	1,204	777	673	210	54	8,555	12·88	2,751	4	7
157	Tanna	879,093	413	400	356	246	1,251	3,257	3,129	3,331	1,051	558	326	327	14,645	13·88	5,969	...	9
158	Colaba	366,051	178	183	40	44	82	913	940	1,435	548	133	61	157	4,714	10·73	1,453	...	9
159	Bombay City	708,801	261	298	433	417	684	1,069	1,262	998	487	302	139	216	6,566	7·72	2,510	19	10
160	Poona	875,029	656	166	217	700	3,029	4,930	4,020	2,743	1,199	441	314	270	18,685	17·79	4,649	...	10
161	Ratnagiri	989,685	109	270	217	128	124	986	1,822	1,272	642	281	249	67	6,167	5·19	3,125	...	6
162	Kaladgi	698,504	677	950	1,898	3,246	4,262	2,472	1,699	1,552	766	443	295	222	18,482	22·05	7,124	...	9
163	Belgaum	901,382	1,443	1,423	3,027	4,532	5,272	2,362	990	624	763	1,738	750	1,232	24,156	22·33	8,357	...	7
164	Dharwar*	809,654	2,198	2,780	4,065	3,125	1,989	1,210	444	380	477	1,227	936	1,294	20,125	20·71	8,779	...	5
	Total	8,992,333	6,153	6,722	11,543	16,167	24,173	26,366	17,971	14,778	7,092	5,969	3,752	4,081	144,767	...	...	...	...
	Average Death-rate of each Month per 10,000 of Population		·57	·62	1·07	1·50	2·24	2·44	1·67	1·37	·66	·55	·35	·38		—13·42			
	Percentage of Deaths in each Month		4·3	4·6	8·0	11·2	16·7	18·2	12·4	10·2	4·9	4·1	2·6	2·8		=100			

* Statistics of 1871 not available.

No. XII.

The Districts of the Madras Presidency.

Serial Number.	District.	Average Population.	Number of Deaths from Cholera registered in each Month.												Total number registered in the 12 years.	Average annual death-rate per 10,000 of population.	Maximum number of deaths in any one of the 12 years.	Minimum number of deaths in any one of the 12 years.	Number of years in which the death-rate exceeded 1 per 10,000.
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.					
165	Ganjam	969,084	672	813	2,585	3,046	3,316	3,436	3,079	1,405	565	299	1,196	1,077	21,489	18·48	8,384	73	9
166	Vizagapatam	1,325,105	613	966	1,803	1,007	947	2,345	3,768	2,529	1,614	1,124	1,215	937	18,868	11·87	6,923	...	6
167	Godavery	1,509,783	1,566	439	223	304	2,180	4,416	9,640	6,827	3,310	2,075	1,870	1,420	34,270	18·92	9,548	...	6
168	Kistna	1,449,659	3,677	3,354	2,133	838	1,150	2,325	4,226	4,967	3,626	941	551	1,395	29,183	16·78	12,374	...	6
169	Nellore	1,231,132	10,038	5,430	1,807	778	493	549	973	2,942	3,053	1,141	1,352	4,357	32,913	22·28	19,476	...	6
170	Madras	389,739	1,964	1,493	853	610	1,158	625	711	853	611	320	401	714	10,313	22·05	6,246	...	7
171	Chingleput	859,306	2,067	766	412	384	731	554	1,128	1,019	560	466	442	591	9,120	8·84	4,391	...	5
172	South Arcot	1,755,570	5,262	3,971	2,928	2,173	3,392	3,015	7,826	8,271	4,569	1,831	2,033	3,239	48,510	23·03	25,783	8	7
173	Trichinopoly	1,102,991	4,874	1,911	1,442	1,530	2,507	2,458	5,047	4,425	2,938	1,228	1,500	3,640	33,500	25·31	15,447	...	8
174	Tanjore	1,845,044	11,306	5,281	1,802	939	3,315	8,004	10,939	4,335	2,668	1,483	941	4,649	55,662	25·14	18,125	23	8
175	Madura	1,238,581	3,004	1,696	1,461	1,273	2,710	1,830	1,679	2,973	2,979	3,939	5,278	5,265	34,087	22·93	15,647	...	7
176	Tinnevelly	1,608,824	5,729	2,534	2,793	2,327	1,207	1,277	1,455	2,623	3,346	2,187	2,219	6,539	34,236	17·73	14,214	...	7
177	Kurnool	842,545	2,051	1,550	2,324	2,703	2,485	1,846	2,083	1,627	947	394	1,068	6,061	25,139	24·86	11,758	...	5
178	Cuddapah	1,247,863	10,192	8,430	3,781	2,852	3,603	3,970	5,226	5,303	3,586	1,212	1,335	4,062	53,552	35·76	33,102	...	5
179	Bellary	1,666,911	4,341	7,652	8,569	5,985	5,856	6,590	4,869	2,681	1,219	1,022	1,701	3,126	53,611	26·80	30,183	...	4
180	North Arcot	2,014,766	13,250	11,032	7,551	4,205	4,840	3,069	5,172	5,699	4,107	2,649	1,693	4,528	67,795	28·04	42,145	...	7
181	Salem	1,966,679	9,686	9,549	10,280	9,846	9,129	3,585	2,790	3,083	4,014	2,510	3,161	6,144	73,777	31·26	47,633	...	8
182	Coimbatore	1,762,976	4,099	4,712	3,439	4,154	6,489	4,420	3,281	3,549	5,620	4,798	6,019	6,578	57,158	27·02	36,622	...	7
183	Neilgherries	60,949	...	28	42	132	214	69	11	14	11	8	...	9	538	7·36	476	...	5
184	South Kanara	918,202	432	272	203	332	176	338	367	370	388	537	714	712	4,841	4·39	2,900	...	6
185	Malabar	2,244,739	2,711	2,300	2,406	2,631	2,604	3,451	3,152	2,786	1,293	959	1,387	1,865	27,545	10·23	11,303	5	6
	Total	28,010,448													726,107				

No. XIII.

The Districts of British Burma.

Serial Number.	District.	Average Population.	Number of Deaths from Cholera registered in each Month.												Total number registered in the 12 years.	Average annual death-rate per 10,000 of population.	Maximum number of deaths in any one of the 12 years.	Minimum number of deaths in any one of the 12 years.	Number of years in which the death-rate exceeded, 1 per 10,000.
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October	November.	December.					
186	Akyab	313,600	231	172	496	457	349	805	566	406	361	75	118	172	4,208	11·18	1,340	...	8
187	Kyaukpyu	145,111	82	71	43	134	101	229	576	415	330	350	144	29	2,504	14·38	732	...	5
188	Sandoway	57,063	...	...	1	4	1	...	12	49	86	221	81	...	455	6·64	285	...	5
189	Hanthawaddy	495,902	481	513	426	375	390	518	829	381	182	181	384	666	5,326	8·95	2,248	...	10
190	Thonegwa*	214,120	623	405	293	378	339	370	168	52	28	90	264	1,037	4,047	23·63	1,083	206	8
191	Bassein	343,929	372	384	774	1,007	558	463	278	200	121	89	295	494	5,035	12·20	1,393	8	11
192	Henzada	376,700	209	351	308	338	299	311	1,021	1,052	462	175	299	175	5,000	11·06	1,575	15	11
193	Tharrawaddy†	255,704	80	10	1	36	46	22	348	397	162	227	362	170	1,861	14·56	693	67	5
194	Prome	280,141	222	129	339	427	206	163	1,388	1,046	548	579	531	299	5,877	17·48	1,439	...	8
195	Thayetmo	147,841	16	35	79	109	148	181	995	1,092	123	57	101	31	2,967	16·72	1,187	...	9
196	Amherst	298,308	167	328	521	417	608	268	100	48	14	47	114	188	2,820	7·88	764	5	8
197	Tavoy	78,241	193	118	35	...	8	2	23	28	113	213	158	158	1,049	11·17	662	...	8
198	Mergui	50,660	92	136	74	28	29	21	54	59	52	96	107	100	848	13·95	423	...	6
199	Shwegyin‡	156,887	287	124	80	82	61	52	99	83	60	120	182	366	1,596	9·25	401	...	8
200	Toungoo	103,627	42	2	71	58	12	6	69	34	53	178	101	57	683	5·49	325	...	5
	Total	3,317,834													44,276				

* For 8 years, 1875 to 1882.

† For 5 years, 1878 to 1882.

‡ Statistics of 1871 not available.

No. XIV.

Districts of Assam.

Serial Number.	District.	Average Population.	Number of Deaths from Cholera rrgistered in each Month.											Total number registered in the 12 years.	Average annual death-rate per 10,000 of population.	Maximum number of deaths in any one of the 12 years.	Minimum number of deaths in any one of the 12 years.	Number of years in which the death-rate exceeded 1 per 10,000.
			January.	February	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.					
201	Lakhimpur* . .	150,580	48	46	81	263	737	801	600	180	126	44	201	76	3,203	19·34	855	22	11
202	Sibsagar . . .	333,432	1,066	815	1,485	1,824	1,170	876	641	335	276	803	2,334	2,563	14,188	35·46	3,919	337	12
203	Nowgong . . .	283,484	355	173	479	1,520	2,434	3,594	2,454	773	641	1,049	1,488	1,222	16,182	47·57	3,106	168	12
204	Darrang . . .	254,670	166	263	1,084	2,394	3,087	2,868	1,788	699	236	329	352	561	13,827	45·24	4,148	59	12
205	Goalpara . . .	445,496	421	250	268	815	1,513	975	903	420	279	812	922	1,070	8,648	16·18	2,288	57	12
206	Cachar . . .	247,226	235	342	488	734	824	456	135	59	84	99	274	417	4,147	13·98	1,342	5	11
207	Sylhet . . .	1,844,274	2,534	1,567	2,067	3,525	3,425	1,324	438	350	476	1,514	2,974	4,188	24,382	11·02	7,393	39	11
208	Kamrup . . .	603,321	2,189	1,072	1,335	2,337	5,544	6,359	4,515	2,515	1,530	1,062	1,084	1,711	31,253	43·17	7,896	320	12
	Total .	4,162,483													115,830				

* Statistics of 1871 not available.

No. XV.

Districts of Bengal, North-Western Provinces, Central Provinces, and Bombay not included in above returns.

Serial Number.	District.	Average Population.	Number of Deaths from Cholera registered in each Month.												Total number registered in the 12 years.	Average annual death-rate per 10,000 of population.	Maximum number of deaths in any one of the 12 years.	Minimum number of deaths in any one of the 12 years.	Number of years in which the death-rate exceeded 1 per 10,000.
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.					
209	Darjeeling . . .	124,947	29	58	219	176	320	1,113	429	91	27	15	12	22	2,511	16·75	1,734	...	9
210	Jalpaiguri . . .	500,113	26	55	95	275	974	1,112	570	257	153	242	287	404	4,450	7·41	1,353	11	7
211	Chittagong . . .	1,129,872	5,978	2,664	1,575	2,528	3,383	1,306	730	703	539	165	2,943	7,232	29,746	21·94	9,300	12	10
212	Banda . . .	711,490	180	177	33	258	1,189	3,795	2,856	1,326	631	169	25	2	10,641	12·46	2,337	7	10
213	Hamirpur . . .	514,139	34	20	3	16	349	2,158	4,244	2,820	502	159	3	6	10,314	16·72	5,655	1	10
214	Mandla . . .	244,729	...	13	98	79	59	274	575	661	394	16	1	...	2,170	7·39	1,091	...	6
215	Kanara* . . .	398,310	239	330	514	646	317	309	376	415	235	189	164	122	3,856	8·80	2,804	...	4
	Total .	3,623,600													63,688				

* Returns for 1871 not available.

A. STEPHEN, M.B., *Surgeon-Major,*

Statistical Officer to the Government of India, in the Sanitary and Medical Departments.

Appendix B.

Statement showing the Mortality among Emigrants proceeding to Assam by Steamer during each of the seven years 1877-78 to 1883.

Year.	Place of embarkation.	Number em barked at each place.	Total embarked.	Percentage embarked.	Number of Deaths.			Death-rate per 1,000.		
					Cholera.	All other causes.	Total.	Cholera.	All other causes.	Total.
1877-78	Goalundo	17,366	25,269	68·7 = 100	297	171	468	17·10	9·85	26·95
	Dhubri	7,903		31·3	10	126	136	1·27	15·94	17·21
1878-79	Goalundo	16,495	23,490	70·2 = 100	422	202	624	25·58	12·25	37·83
	Dhubri	6,995		29·8	?	?	170	?	?	24·30
1879-80	Goalundo	6,333	12,911	49·1 = 100	40	27	67	6·32	4·26	10·58
	Dhubri	6,578		50·9	?	?	39	?	?	5·93
1880-81	Goalundo	3,294	10,268	32·1 = 100	...	3	3	...	·91	·91
	Dhubri	6,974		67·9	12	8	20	1·72	1·15	2·87
1881	Goalundo	3,341	12,364	27·0 = 100	...	6	6	...	1·80	1·80
	Dhubri	9,023		73·0	2	10	12	·22	1·11	1·33
1882	Goalundo	3,689	16,325	22·6 = 100	21	6	27	5·69	1·63	7·32
	Dhubri	12,636		77·4	65	14	79	5·14	1·11	6·25
1883	Goalundo	3,908	20,690	18·9 = 100	13	3	16	3·32	·77	4·09
	Dhubri	16,782		81·1	62	57	119	3·69	3·40	7·09

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b. JK.S.23

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